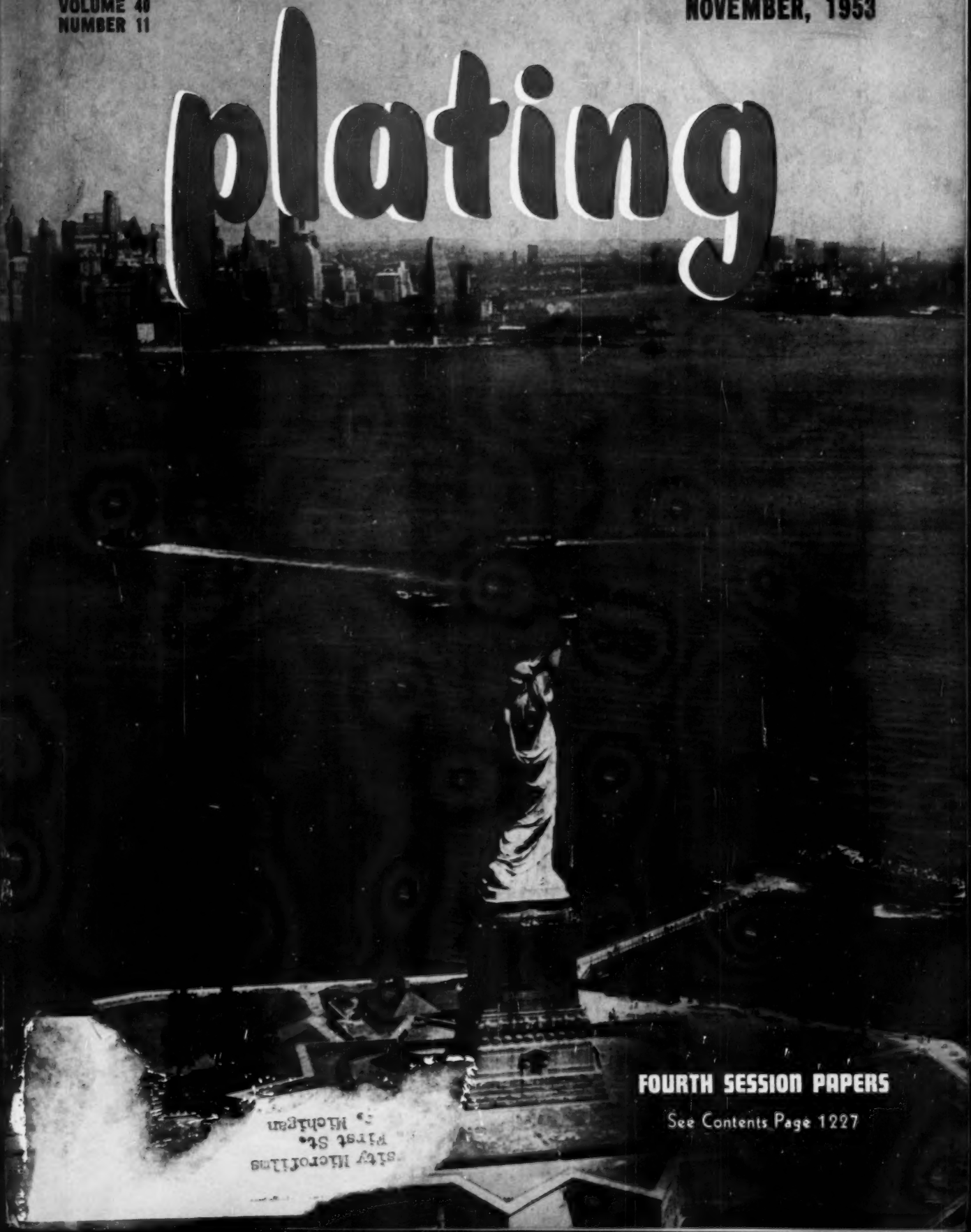
VOLUME 40
NUMBER 11

NOVEMBER, 1953

plating



FOURTH SESSION PAPERS

See Contents Page 1227

City Microfilms
First St.
, Michigan

For ALUMINUM
Etching and Deoxidizing

SAT-N-ETCH
Process

The simple low-cost method, that →

1. Eliminates caustic scale on tanks
2. Eliminates hazzardous acids and excessive fumes
3. Is easily controlled
4. Produces a clean, smooth, satin finish on all wrought Aluminum.
5. Produces a finish suitable for inert arc welding, spot welding, anodizing, painting, etc. Or, as a final silvery, pleasing-in-appearance finish.

Ask your Clepo Service Engineer for a demonstration or write for further information to

CLEPO — CLEANING COMPOUNDS

FREDERICK GUMM Chemical Company Inc.
538 FOREST STREET, KEARNY, N.J.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 1300.

NEW RESEARCH PRODUCTS FOR METAL FINISHING

"ALKA-DEOX" DESCALING PROCESS — An electrolytic alkaline derusting and descaling process for steel and many alloy steels. Fast acting without attack on base metal. Removes smuts. Less hydrogen embrittlement than with acids. Uses Enthone Compound 134.

ACTANE 33 — A crystalline product that replaces hydrofluoric acid for many operations — etching, bright dipping of aluminum. Also used in pickling stainless steel and removing silica. Less hazardous to handle than HF.

COMPOUND NR-28 — A very effective water soluble rust inhibiting compound for steel. Neutral in reaction. A powdered material used 1 - 2 oz/gal.

COMPOUND NR-37 — An organic material added to cold or hot water to prevent rusting of steel, cast iron and *porous* iron including powdered iron parts during storage or during drying of the water film. Leave no residue after the water has evaporated.

DESCALER 2A — A powdered acidic compound added to water to make pickling solutions for iron and steel. Safer to handle than sulphuric acid. Gives controlled acidity to prevent overpickling. Contains surfactants to promote more uniform and cleaner pickling.

ENAMEL STRIPPER 95 — An emulsifiable solvent type stripper for uncured lacquers and enamels. Can be used for stripping uncured materials from defective work and is also used for cleaning of spray paint booths and spray equipment. Overcomes hazards of the use of thinners for cleaning purposes.

ENTHOX — Chromating process for zinc and cadmium. Very easy to use and economical. Stops corrosion in damp atmospheres and in salt fog. If you have trouble meeting salt spray specifications on zinc and cadmium use Enthox.

ETCHALUME 14 — A new fast etching, uniform acting, alkaline cleaning and etching agent for aluminum to prepare it for painting or to procure a final etched finish.

ZINC DIE CASTING STRIPPER (COMPOUND L-88) — An electrolytic stripper for removing chromium, nickel and copper from zinc base die castings. Leaves the die casting in a clean condition ready for refinishing.

Write for check list of literature on more than sixty products and processes for modern metal finishing.

METAL FINISHING PROCESSES

ENTHONE
INCORPORATED
442 ELM STREET
NEW HAVEN, CONNECTICUT

ELECTROPLATING CHEMICALS

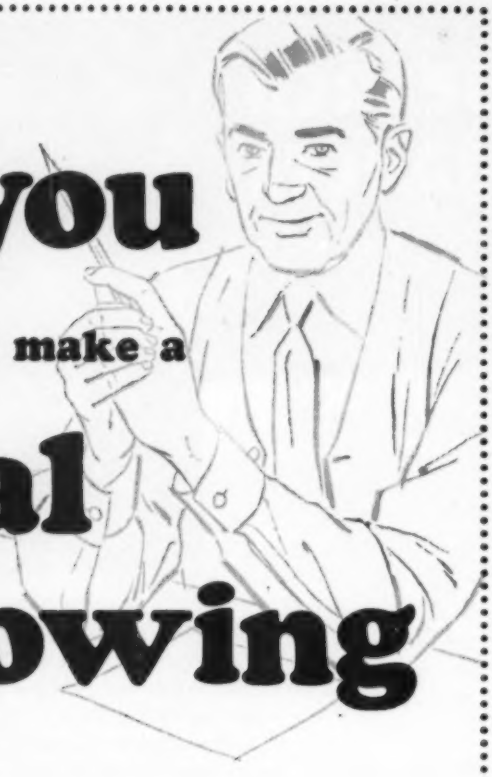
SERVICE REPRESENTATIVES AND STOCK POINTS

ARDCO, INC.
5000 West 73rd Street
Chicago 38, Illinois

R. O. HULL & COMPANY
1300 Parsons Court
Rocky River, Ohio

L. H. BUTCHER COMPANY
3628 East Olympic Blvd.
Los Angeles, California

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 1301.



if you

want to make a

real showing

in your

plating

Ask MEAKER

With over fifty years' experience manufacturing automatic plating machines custom built for highest production at lowest unit cost for some of the largest plating departments, MEAKER has the know-how to help you make a real showing in your plating. For the complete story, ask The Meaker Company, 1639 So. 55th Ave., Chicago 50, Ill.

MEAKER PRODUCTS

Full Automatic and Semi-Automatic Electroplating Equipment
Batch-Type Continuous Electroplating Machines
Strip Steel Plating Equipment • Wire Galvanizing Equipment
Pickling Machines • Process Conveyors
Motor Generators and Rectifiers

Special Machines for the Unusual Requirements

4483

In This Issue

Discussion—Question and Answer Session at the Philadelphia Convention. A panel composed of authors of Educational Sessions papers, with Dr. Brenner acting as moderator provides answers to problems cited at the recent A.E.S Convention.

An Electronic Thickness Gage by A. Brenner and J. Garcia-Rivera is a paper that describes a new instrument for thickness measurements. The unit makes possible the measurement of the thickness of coatings on metals provided the conductivities of the coating and basis metal differ sufficiently. Measurements are nondestructive and can be made on combinations of metals regardless of whether they are magnetic or nonmagnetic.

Thickness of Electrodeposited Coatings by the Anodic Solution Method by C. F. Waite. In this paper the author reports his findings of investigations prompted by unsatisfactory results with the conventional drop-test method for the measurement of chromium coatings on copper plated steel. The method, using both a laboratory built instrument and a commercially built unit, has been found successful in the measurement of electroplated coatings of copper, zinc, cadmium and nickel on steel, chromium and nickel on copper, and chromium on nickel.

Testing of Organic Finishes and Interpretation of Results by C. O. Hutchinson. The author describes over 60 properties of organic finishing materials used as a basis of evaluating these coatings. He also lists standard test procedures for most of these properties, together with essential control conditions and typical values for some industrial products on which these tests are used. He presents a bibliography of valuable references on testing of organic finishes and interpretation of results.

A E. S. Research Report. Project No. 12, VII. Final Summary on Degreasing Evaluation Tests by Henry B. Linford and Edward B. Saubestre. The authors summarize the results of their findings on this phase of the Project studies—the development and evaluation of testing procedures.

For page numbers, see Table of Contents, page 1227

Published monthly at 5800 N. Marvine St., Philadelphia 41, Pa. Entered as second class matter July 1, 1946, at the Post Office at Philadelphia, Pa., under Act of August 24, 1916. Subscriptions: Domestic and Canada, $4.00 for 1 year, $7.00 for 2 years 50c per copy; Foreign, $8.00 per year, $1.00 per copy

SPECIFY....

Clip To Your Letterhead

Schaffner manufacturing company, inc.
SCHAFFNER CENTER, EMSWORTH, PITTSBURGH 2, PA.

Please send Grease Stick samples to:

Name _____ Title _____
Company _____
Street _____
City _____ Zone _ State _____

Schaffner

'The COMPLETE Line!'

Lime · Stainless · Tripoli
Grease Stick · Aluminum

Bar Compounds
In any size and shape

Cold Polishing
Wheel Cement

7 Assorted Anodes
Assorted Hooks

Buffs - A complete assortment

SEND FOR SAMPLES AND PRICES TODAY

Clip To Your Letterhead

Schaffner manufacturing company, inc.
SCHAFFNER CENTER, EMSWORTH, PITTSBURGH 2, PA.

Send me free samples on the following:

_____

Name _____ Title _____
Company _____
Street _____
City _____ Zone_State _____

Industry News

New Plant. A new $3,000,000 mine and plant to produce ilmenite, the raw material for titanium metal and pigments, will be constructed for the DuPont Company near Lawtey, in north central Florida, it was announced.

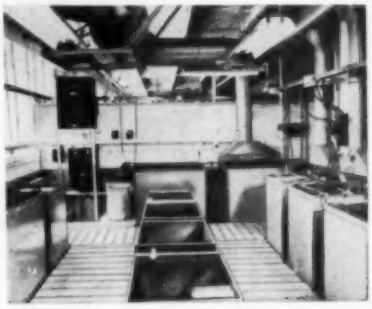
Construction will start soon and the schedule calls for completing the installation and getting it into operation early in 1955. It will be known as the Highland plant.

Pennsalt Enters Paint Bond Field With New Fosbond Line. The Pennsylvania Salt Manufacturing Co., 1000 Widener Bldg., Philadelphia 7, Pa., has entered into the field of chemical specialities for phosphatizing metals for corrosion resistance and paint bonding with a complete line of products for this field under the trade name "Fosbond".

For the past several years, Pennsalt has been manufacturing and marketing phosphate coatings, metal cleaners and lubricants for the cold working of steel. The new Fosbond line rounds out the Company's activities in the entire field of phosphate coatings and virtually completes Pennsalt's line of metal processing chemicals.

Federated Opens New Research Foundry. Federated, a division of American Smelting and Refining Company, has installed in its new research foundry at South Plainfield, N. J., all the modern equipment necessary to make it a proving ground for the solution of typical problems besetting Federated customers. Particular attention, both from a research and from a practical standpoint, will be given to melting techniques, gating practices and pouring procedures. There will be ample opportunity, too, for the testing of newly developed alloys in the same way that customers would be using them. The new Research foundry is a significant development in Federated's continuing program to improve customer service.

New Facilities for J. C. Miller. The J. C. Miller Company of Grand Rapids, Mich., has recently established unique laboratory facilities for product testing and product control. One section of the laboratory contains complete pilot line



plating facilities where all newly developed buffing compound formulas and production samples are checked for cleanability and subsequent platability. This section of the laboratory facilities enables plant engineers to evaluate and recommend proper compounds consistent with job requirements and client's cleaning cycle. Product control personnel constantly check production samples to assure uniformity in accord with the company's policy of "controlled compounds".

Also recently put into service is a new fleet of trucks. While numerous shipments are made by common carrier the company has, due to current product demand, found it necessary to add their own fleet. These additional facilities are necessary to assure prompt delivery of the volume of materials shipped to manufacturers throughout the nation.

Sustaining Memberships

Reports of additional A. E. S. Research memberships from Tennessee and California have been sent in to Headquarters. The two new members, whose dues enlarge the funds provided by the memberships (now over 350) in support of the Society Research Program:

Diamond Plating Company, Memphis, Tenn.
Spence Electro-Plating Company, Los Angeles, Calif.

HAVEG
Trade Mark Reg. U.S. Pat. Off

MOLDED TANKS
built to STOP CORROSION

Does corrosion eat into your profits, contaminate your products, increase your maintenance costs? Haveg, the plastic material most effective against corrosion, will solve your problems. It can be custom-engineered to fit your requirements. Haveg is not a lining or coating, but a moldable, thermosetting plastic made of acid-digested asbestos and special resins that resist acid, alkali, solvent, corrosion. Haveg tanks last for years and years . . . even when used continuously in temperatures as high as 265 degrees F., with a good margin of safety.

In addition to its remarkable corrosion-resistance, Haveg is strong; has low heat conductivity (seldom requires insulation); and can be repaired, altered or machined on the spot. Haveg Corporation has both the molds and experience to make tanks quickly . . . in any style, size, baffle design to fit your needs. Pipe (plain or perforated), fume duct, pumps, valves, heat exchangers also are made by the Haveg Corporation. For engineering assistance, complete information about Haveg, call your Haveg sales office. Write today for 64-page descriptive Bulletin F-6.

PUMPS TANKS PIPE

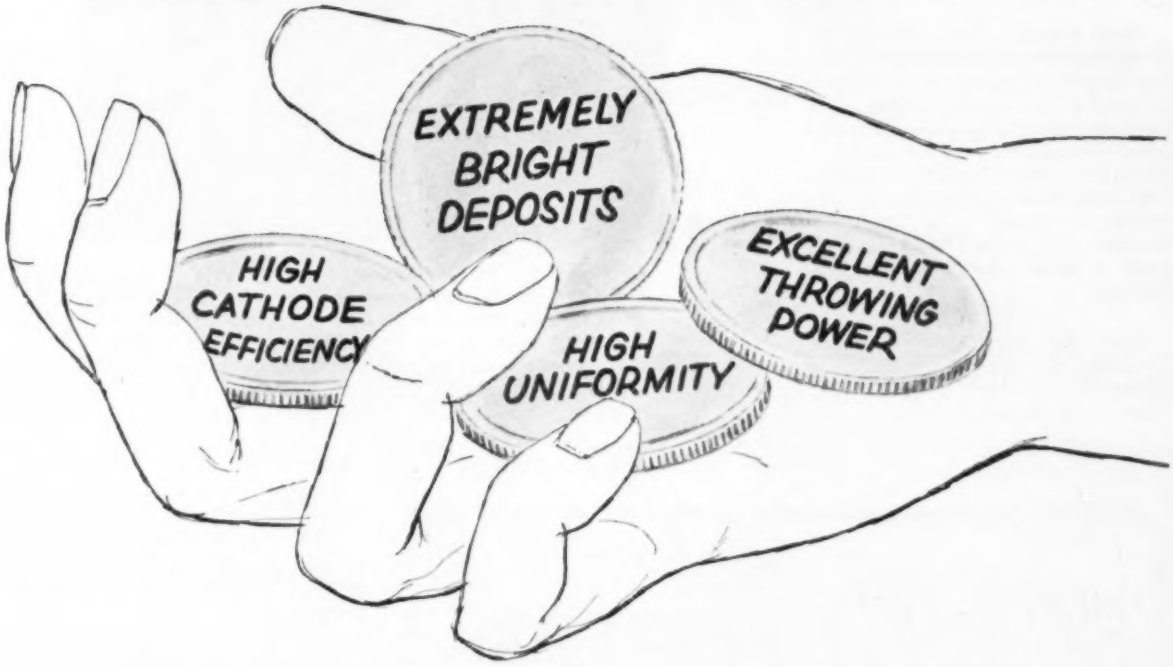
HAVEG CORPORATION*
Trade Mark Reg. U.S. Pat. Off.
NEWARK, DELAWARE
FACTORY: MARSHALLTON, DEL.
Wilmington 3-8884

ATLANTA Exchange 3821 CHICAGO 11 Delaware 7-0088 CINCINNATI 37 Valley 1610
CLEVELAND 20 Washington 1-8700 DETROIT 35 Broadway 3-0840
HARTFORD 5 Hartford 6-4230 HOUSTON 4 Jackson 6840 LOS ANGELES 14 Mutual 1105
SEATTLE 7 Hemlock 1351 ST. LOUIS 17 Hiland 1223

* A Subsidiary of Continental-Diamond Fibre Company.

SEND FOR 64-PAGE HAVEG BULLETIN F-6.

Get extra dividends from your cadmium plating



...with DU PONT "CADALYTE" PLATING SALTS AND "CADALYTE" BRIGHTENER

YOU CAN be sure of extra returns for every plating dollar with Du Pont "Cadalyte"—the *complete* cadmium plating salt. "Cadalyte" contains all the chemicals needed for an efficient plating bath . . . simplifies production over a wide range of operating conditions.

Easily operated and maintained, the "Cadalyte" bath has excellent throwing power and high cathode efficiency. Lustrous uniform deposits are obtained directly from the bath at high current densities. You can make a fresh solution by simply dissolving "Cadalyte" in water . . . or use "Cadalyte" for replenishing the metal content of existing baths.

"CADALYTE" BRIGHTENER maintains the high covering power of the bath at its peak . . . assures brilliance and uniformity of deposits. It may be added separately or with sodium cyanide in "Cadalyte" Maintenance Compound.

We can supply your cadmium anode requirements from conveniently located stock points in 11 principal cities. For complete information—including practical plating advice and descriptive literature on Du Pont plating chemicals—contact our nearest district office, or send in the coupon below.

DISTRICT OFFICES:
Boston . Charlotte . Chicago . Cincinnati . Cleveland . Detroit
El Monte (Calif.) . Kansas City* . New York . Philadelphia
*Barada & Page, Inc.

Chemicals · Processes · Service
for ELECTROPLATING

DU PONT
REG. U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING
...THROUGH CHEMISTRY

E. I. du Pont de Nemours & Co. (Inc.) P-113
Electrochemicals Dept., Wilmington 98, Del.

Please send me complete information on Du Pont Plating Chemicals—properties, advantages and recommended procedures. I am interested in the following types of plating:

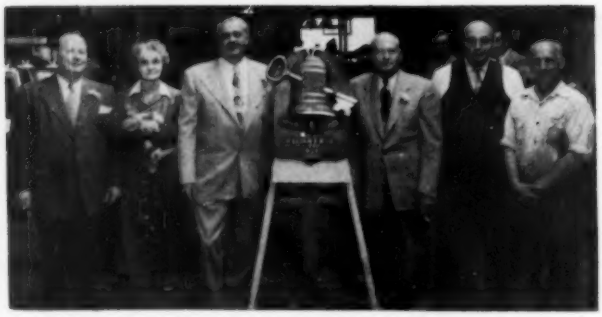
☐ Cadmium Plating ☐ Tin Plating
☐ Copper Plating ☐ Zinc Plating

*Name*_____ *Position*_____
*Firm*_____
*Street & No.*_____
*City*_____ *State*_____

Industry News

Name Change. The American Ventilating Hose Company, a division of Callahan Zinc-Lead Company, Inc., is changing its name to The Flexaust Company. Because the uses of its products, Flexaust, a spiral-wire reinforced hose; Portovent, a hose with excellent lengthwise compressibility; and Bloflex, a collapsible hose, have spread to virtually every industry in America, the company is changing its name to better identify itself with its product.

Tungsten Institute Organized. Formation of the Tungsten Institute with headquarters in Washington at 1757 K Street N. W., has been announced.



Commemorating the thirtieth anniversary of Belke Manufacturing Company, the employees presented a large bronze casting of the Company trade mark to William E. Belke, Founder and President. Shown are Mr. Belke with five employees that have been with the Company through the 30 years. Left to right: Harvie Johnson, Mrs. Gertrude Trimmer, William E. Belke, Roy Johnson, Sigmund Fabry and Leo Lang

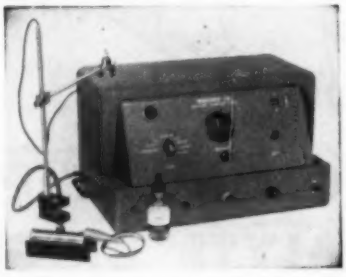
It was stated this is the first time in the history of the tungsten mining industry of the United States that a group of companies have undertaken a cooperative program in behalf of this important strategic metal.

Carbon Dioxide in Water. The problem of corrosion of steam condensate systems is due to a large extent to the reduction of the *p*H of the condensate by carbon dioxide evolved in the boiler, according to a paper presented at the recent meeting of the American Chemical Society, Chicago, Ill.

The paper, "Determination of Low Amounts of Carbon Dioxide in Water", by J. B. Smith, E. K. Gilbert and M. Howie of The Permutit Company, New York 36, N. Y., declares that analysis of condensate and boiler feed water for total carbon dioxide of less than approximately 0.5 ppm has, in the past, been accomplished by direct means. The authors

HERE'S WHY

it's easier to do your thickness testing with the



KOCOUR ELECTRONIC THICKNESS TESTER

1 Thickness testing is no longer a tedious, time consuming task. Tests require only about a minute to make.

2 Very simple to operate . . . no highly skilled technicians are required.

3 The instrument is virtually automatic . . . readings are direct . . . the human element does not affect the accuracy which ranges from 90–95%.

4 The minimum thickness which can accurately be determined is 5 millionths of an inch (5 ten-millionths of an inch for chromium.)

5 Requires no graphs, no charts, no standards or calculations.

6 Magnetic properties of either the base metal or the plating do not affect the test in any way.

7 Guaranteed satisfaction

* Operation 105–125 Volts, 60 cycle A. C.

Write today for complete information

KOCOUR COMPANY

4801 S. St. Louis Ave.
Chicago 32, Illinois

• Pioneers & Specialists in Test Sets & Instruments for the electroplating industry since 1923.

Specify KOCOUR TEST SETS from your supplier.

CHEMICAL ENGINEER

Seventeen years' experience in all phases of electroplating, engineering and personnel supervision. Desires position as Chemical Engineer supervisor. *Reply to:*

P-1153-A, PLATING
445 Broad St., Newark 2, N. J.

POSITION AVAILABLE

Plating chemist for job shop plant. Fast growing concern, permanent position. Opportunities. *Reply to:*

P-1153-B, PLATING
445 Broad St., Newark, N. J.

CATERPILLAR TRACTOR CO. finds parts come clean with PENNSALT CLEANER

Get a better start for your finish!

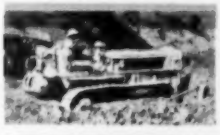
In its Peoria, Ill., plant, Caterpillar Tractor Co. uses power spray washers to remove cutting oils and rust preventives from steel and cast iron parts . . . prior to assembly or further processing. In past years, the Company has tried several types of cleaners in an effort to make the spray wash operation as economical and efficient as possible.

Some months ago a Pennsalt service man suggested a trial of a Pennsalt Cleaner. The results of the test were highly satisfactory: the Pennsalt Cleaner maintained Caterpillar's standards of quality and efficiency while proving considerably more economical. This Cleaner is now used in 71 power spray washers.

Many another plant has come to the same conclusions about Pennsalt Cleaners. They have powerful detergent effect and long working life.

The feature that makes Pennsalt Cleaners all the more remarkable—and desirable—is their economy. While outperforming competitive cleaners, they almost always prove to be considerably cheaper to use.

An experienced Pennsalt service man in your area will be glad to tell you more about the many specialized cleaning products in the complete Pennsalt line. For the name of the Pennsalt man nearest you, or for further information, write: Metal Processing Department, Pennsylvania Salt Mfg. Co., 443 Widener Bldg., Philadelphia 7, Pa.



Pennsalt Chemicals

NEW FEDERATED ZINC ANODES

... Better Than Ball Anodes

... No Flash ... No Gate ... No Voids

Make your plating job easier by using Federated Zinc Anodes, the smooth zinc anodes that won't catch or stick when you drop them into the container.

These anodes are round on top, flat on the bottom ... scientifically designed and cast in an open mold to give you a smooth-finish anode without voids or inclusions.

The material used for Federated Zinc Anodes ... special high-grade zinc and no scrap ... and Federated's known superiority in production combine to make these anodes the best on the market.

To order or to obtain further information on Federated Zinc Anodes or on any other anodes for the plating industry, call or write any one of Federated's 24 sales offices across the country. There is one near you.

Federated Metals Division

AMERICAN SMELTING AND REFINING COMPANY
120 BROADWAY, NEW YORK 5, N. Y.
In Canada: Federated Metals Canada, Ltd., Toronto and Montreal

Federated first in the non-ferrous field — FMD

Aluminum and Magnesium, Babbitts, Brass and Bronzes, Anodes, Die Casting Metals, Lead and Lead Products, Solders, Type Metals

Industry News

point out that a newer method has been perfected to allow the determination of total carbon dioxide at levels of approximately 0.1 ppm. The system, designed to minimize the introduction of fresh air, and hence CO_2, when introducing the sample, is described and its operation discussed.

Schaffner Manufacturing Opens New Research Laboratory. Schaffner Manufacturing Company, Inc., Schaffner Center, Emsworth, Pittsburgh 2, Pa., have just completed their new experimental and research laboratory. This laboratory is the most modern and up-to-date laboratory in the buffing and polishing industry, and will be used exclusively for research and development work for Schaffner buffing and polishing compositions. However, its personnel and facilities are available to help solve metal finishing problems that arise in the metal finishing industry. The industry is invited to feel free to use this laboratory for their buffing and polishing problems.

New Distributor for Astar. Astar Tumbling Machine Corp. of 36 Clinton St., Yonkers, N. Y., manufacturers of tumbling and burnishing equipment and supplies, have announced the appointment of Jelco Products, 153 E. 26th St., New York, N. Y., as their exclusive distributors in the New York Area.

New Fabricator for Atlas Mineral Products. The Atlas Mineral Products Company of Mertztown, Pa., announces the appointment of Wagner Brothers, Inc., of 400 Midland Ave., Detroit 3, Mich., as their exclusive fabricators in the Detroit area for Ampcoflex®, and Pee Vee Cee®. In addition to the polyvinyl chloride fabrications and fittings line, Wagner Brothers will apply Atlas-Tavon®, Neobon® lining materials.

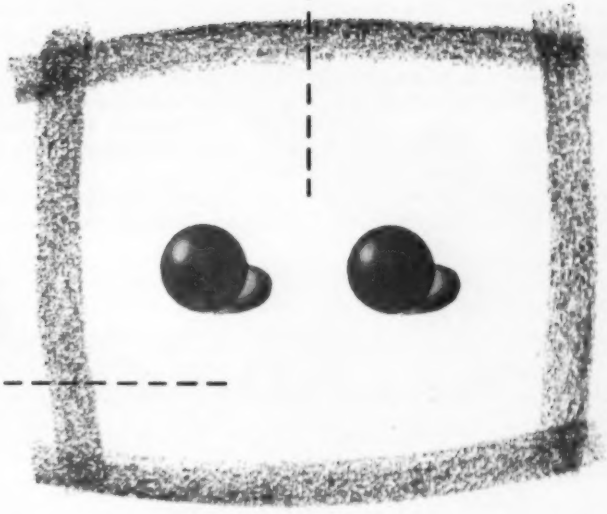
New Laboratory for BMI. Construction has begun on a new laboratory building to house chemical research at Battelle Memorial Institute, Columbus, Ohio, Dr. Clyde Williams, Institute President, announced.

WANTED
BUFFING COMPOUND
SALESMEN

Distributors, Jobbers and Manufacturers Agents to distribute and sell the full line of Schaffner's Polishing and Buffing Composition in Bar, Spray or paste form and a complete line of supplies.

Schaffner Manufacturing Company, Inc.
Emsworth, Pittsburgh 2, Pa.

Let's Talk about PEAS



What have peas got to do with Rectifiers?

JUST THIS: you've heard the phrase "As alike as two peas". Well people who have anything to do with peas — farmers, packers, cooks, and just those who eat peas — know that peas *aren't* all alike.

The next time anyone says to you "Just as good as Green" remember that peas aren't all alike, and neither are rectifiers.

If you want the best... buy GREEN!

W. GREEN ELECTRIC COMPANY, INC.

SELECTRO PLATERS AND ALL TYPES OF RECTIFIER EQUIPMENT

GREEN EXCHANGE BUILDING 130 CEDAR STREET NEW YORK 6, N. Y.

RECTIFIER (G) ENGINEERS

Industry News

The new building will provide 100,000 square feet of additional laboratory space to help meet the continuing space requirements of research for both industry and government.

The new building—Battelle's seventh major structure in Columbus—is slated for completion in the fall of 1954. The four-story brick and concrete structure will have outside dimensions of 63 by 290 feet. Plans include provision for space for pilot plants used in chemical engineering research.

Name Change. The Kold-Hold Manufacturing Company, Lansing, Mich., manufacturer of refrigeration equipment and products in the industrial and domestic heating fields, has announced a change in its corporate name to Tranter Manufacturing, Inc., effective at once.

The change was voted by stockholders who felt that the Kold-Hold name was made inappropriate as the result of a well-established product diversification program.

Beryllium Corporation Exhibits New Products. A new alloy that promises to spread the industrial range of beryllium-copper into new fields was featured as one of the main exhibits of the Beryllium Corporation at the 35th National Metal Exposition held in Cleveland, Ohio.

The new alloy—Beryldur—according to spokesmen of The Beryllium Corporation, is the answer to the need in the metal industries for a copper base material of low beryllium content that would combine properties of the high strength and the high conductivity groups. Beryldur fills the gap between these two so effectively that it opens brand-new vistas of potential application, especially in the field now occupied by phosphor bronze and brass.

Diversey Acquires Subsidiary. The Diversey Corporation has announced the purchase of the Selcon Engineering and Chemical Company of Chippewa Falls, Wis., manufacturers of automatic solution controls and sanitation chemicals. Selcon's compounds are well known in dairy plants and restaurants throughout the north central states although the solution controls manufactured by the company are distributed nationally.

In announcing the purchase, H. W. Kocks, Diversey Chairman, said it was an important step in the expansion plans of the company. In addition to its Chicago plants, Diversey now has factories in Newark, N. J.; South Gate, Calif.; Port Credit, Ontario, Canada, and Honolulu, Hawaii.

Metalweld Adopts New Trademark. Metalweld, Inc., Philadelphia, Pa., has adopted a new MW trademark to better identify the products and services offered by the three divisions of their company.

The MW Protective Coating Division and the MW Industrial Welding Division are in the new plant at Scotts Lane and Abbottsford Ave., and MW's Construction Equipment Division continues in the Hunting Park Ave. plant where the firm has been doing business for the past thirty-five years.

Knapp Mills Forms Mexican Company. Knapp Mills Inc., American producer of lead clad steel and lead clad copper, has announced the formation of Knapp Mills de Mexico, S. A., with headquarters in Mexico City.

Mexico produces approximately 15 per cent of the world's lead. Nevertheless, in order to meet the high standards of the growing chemical and process industries, it is now necessary for Mexico to export its lead to be fabricated into such products as sheet lead and lead pipe because Mexi-

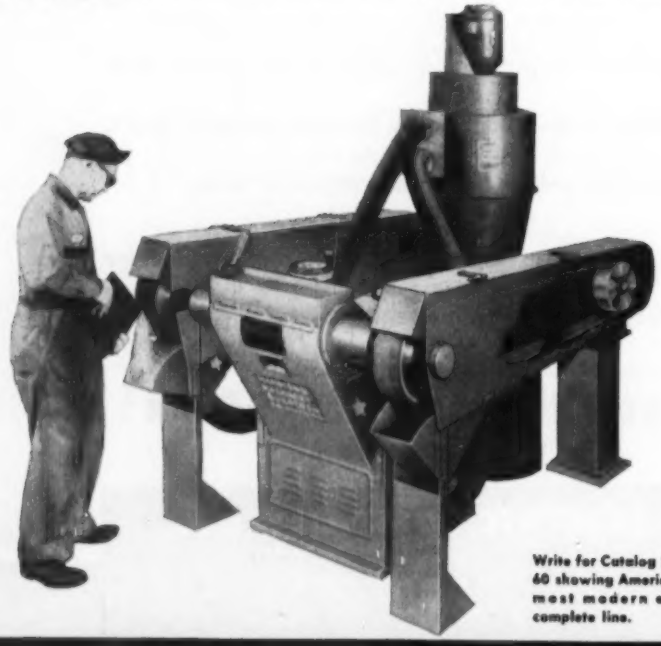
Hammond OF KALAMAZOO
GOOD MACHINERY SINCE '82

MODERN *Self Contained* GRINDER-POLISHER

Hammond Variable Speed (1500 to 3000 RPM) Polishing and Buffing Lathe. Models up to 50 HP available.

Hammond Cyclone Duskolector. One of a wide line of Cyclone and Filter Types.

Hammond Backstands. 10 Air and Spring Tension Models to choose from.



Write for Catalog No. 60 showing America's most modern and complete line.

Hammond Machinery Builders INC
1613 DOUGLAS AVENUE • KALAMAZOO, MICHIGAN

DISTRIBUTORS WANTED
AAA-1 rated manufacturer seeks distributors in South Eastern States and South Central States to handle complete line of buffing wheels and buffing compounds.
Write giving full particulars to:
P-1153-C, PLATING
445 Broad St., Newark 2, N. J.

Just as the sun smiles in the summer, platers from Maine to California smile when they see the results of ROHCO® 100 BARREL ZINC BRIGHTENER. The unequalled acceptance of this brightener is the best proof of its superlative effectiveness. Not only does it perform miracles in producing brightest deposits, but added features are maximum covering power and speed, with deposits that readily accept chromate conversion coatings. You'll smile, too, at the increased business that ROHCO 100 brings when your customers see the results!

R. O. HULL & COMPANY, INC.

1302 Parsons Court • Rocky River 16, Ohio

Canada: Armalite Company, Ltd., Toronto 6, Canada

OTHER ROHCO PRODUCTS: NO-CRO-MIST® • ROHCO 303 STILL ZINC BRIGHTENER • ZINC PURIFIER • ROHCO 20XL CADMIUM BRIGHTENER • RINS-AID • AIRCRAFT BLACK CADMIUM DIP • HULL CELL TEST SETS AND RECTIFIER UNITS • HANGING HULL CELL • CURRENTESTER •

ROHCO

JUST PIN THIS COUPON TO YOUR LETTERHEAD!

R. O. HULL & COMPANY, INC.
1302 Parsons Court
Rocky River 16, Ohio

Please send details on ROHCO 100 BARREL ZINC BRIGHTENER!

Name..... Title.....
Company.....
Street Address.....
City..... Zone..... State.....

can standards of manufacture are not adequate. The finished products then have to be shipped back into Mexico for end use there.

The recently created firm Knapp Mills of Mexico will eliminate the wasteful practice of shipping Mexican lead to America only to be fabricated and shipped back to Mexico in finished form.

Ceramic Coatings for Aluminum, Carbon Steel. To meet the ever-growing demand for protective ceramic coatings for many types of metals used in military, industrial and civilian applications, the General Ceramics and Steatite Corporation has established a new ceramic coating department.

These coatings will be produced by the Chemical Equipment Division in the company's plant at Keasbey, N. J. Ceramic coatings for metals have proven their worth in numerous applications where super-high temperatures and severe operating conditions are continuously encountered.

Well prepared to serve the Metal Industries are these new D-Men, field representatives of the Diversey Corporation's Metal Industries Department, Chicago. They have just completed an intensive technical and sales training course and will sell prefinishing cleaners and etchers to the metal working field. Standing (left to right): W. B. Drake, E. B. Willey, R. E. Erickson, Gene Hasson, H. G. Spotts. Seated: Wayne Polzin, R. L. Shannon, R. O. Bennett

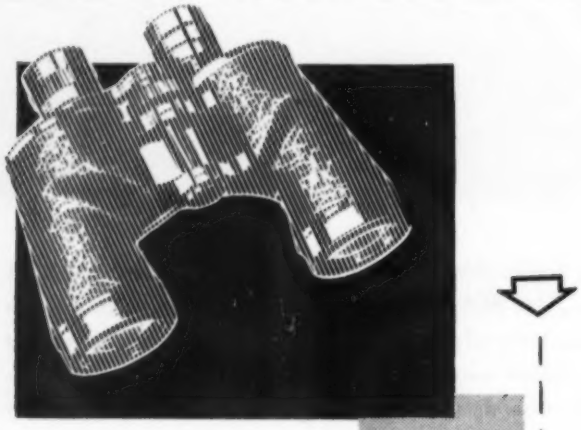
Vanton Pump Changes Name and Plant Location. A change in company name from Vanton Pump Corp. to Vanton Pump & Equipment Corp. has been announced. The new name was decided upon in view of Vanton's addition of corrosion resistant plastic and hard rubber valves, pipe and fittings to its regular line.

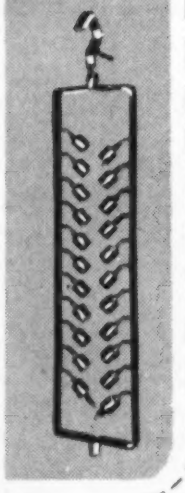
It also has been announced that the Vanton manufacturing plant has been moved from its present location in Long Island City, N. Y., to a new building on the premises of its affiliate company, The Cooper Alloy Foundry Co., Hillside, N. J.

Executive and sales offices will remain at the Empire State Building, New York 1, N. Y.

Elgin and Refinite Unite. Two of the oldest and best known firms in the water conditioning business have united: Refinite Sales Company, Omaha, Neb., has joined forces with Elgin Softener Corporation, Elgin, Ill. Both are respected pioneers and leaders in the water conditioning field, Elgin having been established in 1908 and Refinite in 1916. The combined products of these firms comprise a most complete line of water conditioning equipment and water treating chemicals.

The widely known industrial water conditioning products and services of both companies are now being handled by a combined sales-engineering corporation known as Elgin-Refinite, Inc., a newly created division of Elgin Softener Corp., with headquarters at Elgin, Ill.





KEEP NARACO IN SIGHT!

Leading commercial and industrial manufacturers depend on Naraco's engineering ability to supply the correct fixtures for all plating production problems.

Racks, fixtures and materials handling equipment, designed by Naraco engineers are made from the finest materials, by expert craftsmen and are pre-job-tested to insure uninterrupted production and superior quality plating.

If you too desire, an all encompassing rack and fixture service which will answer all your plating problems—then "keep Naraco in sight"; for only Naraco has the years of experience and know-how that will reward you with satisfaction.

NARACO

NATIONAL RACK CO INC 179-187 Madison Street Paterson, New Jersey

IMPERIAL RACK CO INC 1109 Stewart Avenue Flint Mich

AMERICAN RACK CO 703 W Root Street Chicago Ill

INDUSTRIAL RACK CO 3462 N San Fernando Road Los Angeles, 65 Cal

Have you tried **LIQUIMATIC?**

"Controlled Compounds" in extruded bar and liquid to meet all requirements and conditions of any job.

the perfect liquid compound

Liquimatic®

for all finishing requirements on all metals

Check these features

- FAST CUTTING
- EASY CLEANING
- ADHESIVE, SLOW WEARING BUFF FACE
- NON-SETTLING
- HIGH FLASH POINT
- LONG STORAGE LIFE
- SPRAYABLE VISCOSITY

J. C. Miller Engineers are fully qualified through technical training and years of practical experience to demonstrate and recommend materials and methods for use in your plant — materials and methods that pay you big dividends in higher production and increased savings.

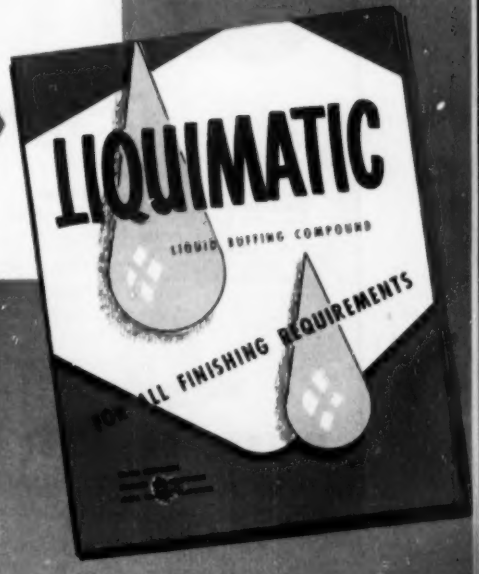
Our Buffing Engineers are equipped with portable Liquimatic demonstration kits which enable them to easily show you the savings that Liquimatic can effect in your plant — on your production line. This demonstration equipment is rapidly set up, requires no assistance from your help and the test can be made on hand lathes or automatic equipment using just a compressed air connection. The demonstration in no way impedes your normal production flow.

Here is a demonstration you should see regardless of past experience or whether or not you are using a liquid compound at present! We know that we can show you that we have achieved the maximum in performance through combining the very latest in automatic application equipment with the very best in compounds — Liquimatic. This is the Liquimatic team — an unbeatable combination.

Send today for your copy of the big, new Liquimatic and Liquimatic Automatic Equipment Brochure. It's full of valuable information for the metal finisher.

LIQUIMATIC . . .

LETS YOUR BUFFS LIVE LONGER



J. C. Miller Quality & Service

Manufacturers of

Tripoli • Stainless Steel Compound • Lime Finish • Cut and Color • Chrome Rouge • Greaseless • Grease Stick • Emery Cake • Burring Compounds

J. C. MILLER Company

631 Chestnut Street

GRAND RAPIDS, MICHIGAN

For your
materials storage

STORTSWELDING*

eliminates
maintenance cost

Stortswelded two-compartment hopper tank, featuring economical design, stout framing and efficient operation.

*STORTSWELDING—a single standard of welding quality for all jobs that pass through our shops.

High precision in cutting, forming, fitting and welding results in a minimum of distortion and residual stresses. You need this quality in your plating cycle tanks. And for long service life you need it in accessory equipment also. It doesn't pay to "get along" with less.

42 STONE STREET — STORTS WELDING COMPANY INCORPORATED — MERIDEN, CONN.

Manufacturers of Welded Fabrications to Specification

FOR FURTHER INFORMATION, USE READER SERVICE CARD: INDICATE A 1314.

CrO_3 Chromic Acid for

DECORATIVE PLATING
HARD CHROMIUM PLATE
ANODIZING ALUMINUM
CHEMICAL CONVERSION COATINGS
STRIPPING COPPER
METAL CLEANING BATHS
ORGANIC SYNTHESIS
MANUFACTURE OF CATALYSTS

The Mutual name and trade mark on a Chromic Acid drum guarantee a product with a minimum assay of 99.75% and a sulfate content not exceeding 0.1%. Chromic Acid of that purity may be used with confidence in any of the applications shown here.

SINCE 1845

MUTUAL CHEMICAL COMPANY OF AMERICA

270 MADISON AVENUE • NEW YORK 16 N. Y.

Intersociety News

The Chemical Institute of Canada

On February 25, 1954 the Institute's Protective Coatings Division will hold the 8th Divisional Conference in Montreal. The next day the same Division will hold its 8th Divisional Conference in Toronto.

American Society for Testing Materials

The Administrative Committee on Standards of the A. S. T. M. approved many new specifications and test methods, and also important revisions in many existing standards. A partial list of the various actions follows:

NEW TENTATIVES—Methods of Test for: Chlorine Requirements of Industrial Water and Industrial Waste Water (D 1291–53T); Odor of Industrial Waste Water (D 1292–53T); Determination of pH of Industrial Waste Water (D 1293–53T).

REVISION OF TENTATIVE—Method of: Spectrochemical Analysis of Zinc-Alloy Die Castings for Minor Constituents and Impurities (E 27–43T).

REVISION OF STANDARD AND REVERSION TO TENTATIVE—Specification for: Zinc-Base Alloy Die Castings (B 86–52).

International Council for Electrodeposition

At the first meeting of the International Council for Electrodeposition, which was held recently at the headquarters of the Institute of Metal Finishing in London, Dr. Walter R. Meyer was warmly welcomed as the official delegate of the American Electroplaters' Society.

The Council considered the plans for the International Conference of 1954 which are now in an advanced stage of preparation. The dates of the Conference have been fixed—Wednesday, April 21, to Saturday, April 24, 1954 and the venue will be London. It is anticipated that there will be whole-hearted participation by overseas delegates; in particular a strong contingent of scientific men and technicians of world-wide reputation from the United States is expected to attend. It is hoped, indeed, to organize a special session to discuss the latest American practice in electrodeposition.

On the eve of the International Conference, a meeting will be held which is to be addressed by Dr. William Blum who has been invited by the Council of the Institute of Metal Finishing to give the Hothersall Memorial Lecture. This function will be under the auspices of the I.M.F. and not the International Council.

FOR FURTHER INFORMATION, USE READER SERVICE CARD: INDICATE A 1315.

HERE'S WHY the Sensational Sel-Rex Bright Gold Process IMPROVES QUALITY ...With LESS GOLD

Just note on the chart below the comparative facts between conventional and SEL-REX golds as confirmed by an independent testing laboratory. SEL-REX gold produces mirror-like deposits regardless of thickness . . . without scratch brushing or buffing. Its exceptional hardness resists abrasion, wear and galling . . . affords far greater corrosion protection. Less gold is required to secure minimum specified thicknesses, yet has unusually good "throwing power" to plate interior surfaces and deep recesses without the need for auxiliary anodes.

- Extra Hard
- Brighter and Smoother
- Excellent Metal Distribution
- More Economical
- Room Temperature Operation

TEST	CONVENTIONAL GOLD	BRIGHT GOLD	RESULT
SMOOTHNESS Profilometer Test Gold Thickness .0005"	Before plating: 1.5 micro-inches R.M.S. After plating: 8.0 micro-inches R.M.S.	Before plating: 1.5 micro-inches R.M.S. After plating: 1.5 micro-inches R.M.S.	BRIGHT GOLD gives exact duplication of the surface plated—does not deform or alter contour. Requires no scratch brushing or buffing.
HARDNESS	Tukon Hardness Converted to Vickers Scale — 65 Knoop Hardness — 47.54	Tukon Hardness Converted to Vickers Scale — 115 Knoop Hardness — 85.51	Less BRIGHT GOLD is required to give greater protection against wear, galling and corrosion.
METAL DISTRIBUTION Thickness Measurement Gold Thickness .001"	Distribution ratio 4 to 1 Edge to Dead Center	Distribution ratio 1.5 to 1 Edge to Dead Center	Less BRIGHT GOLD is required to secure minimum specified thickness. "Throws" well into deep recesses and "blind" holes.
ABRASION TEST Experimental Taber Abraser-CS 10 Wheels 500 gram load	Initial breakthrough 2,400 revolutions Exposure after 9,000 revolutions — more than 40%	Initial breakthrough 3,300 revolutions Exposure after 9,000 revolutions — less than 10%	BRIGHT GOLD gives 40% more protection against wear and abrasion.
SIMPLICITY OF OPERATION	High temperature 140°F.—160°F.	Room temperature 55° F.—75° F.	BRIGHT GOLD bath does not deteriorate, and is easier to control and maintain.

No special equipment is required for plating with SEL-REX BRIGHT GOLD. Conventional racking may be used. The SEL-REX BRIGHT GOLD BATH operates at room temperature and is simple to maintain. Solution is stable. Packaged in 1, 5, and 10 ounce bottles. Send for a trial order of 1-ounce today.

Manufacturers of SEL-REX Silver Sol-U-Salt, Gold and Rhodium

SEL-REX PRECIOUS METALS, INC.

Dept. PL-11 • 229 Main Street, Belleville 9, N. J.

INDICATE A 1316.

Personals

J. P. Arndt, Jr., former Manager of the Crystal Sales Department, has been appointed Assistant General Sales Manager of Brush Electronics Company in charge of staff functions such as sales promotion, advertising, customer service, distribution control, sales training, market research, and order service.

In this new assignment Arndt succeeds **A. J. W. Novak,** Assistant General Sales Manager for Operations, now in a new post as head of all line sales activities including the Equipment Department, Tape Recorder Department, Component Department, and International Department.

Virgil E. Slater has been named Sales Manager of the Forker Corporation, Cleveland.

Slater has specialized in tramrail design and engineering for the past 25 years, and worked in sales engineering on the Pacific Coast for a number of years. Recently, he has been associated with Industrial Crane & Hoist Corp., Chicago, as their eastern manager.

Previously, he organized his own materials handling sales office in St. Louis, known as the Slater Engineering Co., which he operated until he joined Industrial.

A. C. Hillman has been appointed a special consultant by Kelite Products, Inc. In the newly created post, Hillman will give technical field service to users of patented Kelite metal finishing and processing products. Formerly, he was associated with the General Chemical Division of Allied Chemical and Dye Corp., the M. W. Kellogg Company and the C. F. Braun Company. He is an authority in the design and fabrication of chemical engineering equipment and process development, and is a chemical engineering graduate from Columbia.

Robert O. Baughman, another well known rubber technician, has been added to the Automotive Rubber Company's Detroit organization. Baughman, formerly of the Heaveatex Corporation, will

Baughman

be in charge of ARco's newly enlarged rubber product development department. In addition to his functions as the ARco chemical laboratory head, Baughman will assume top responsibilities for latex product development and sales.

Patrick H. Norton has joined the sales engineering staff of Frederic B. Stevens, Inc. He will cover the Stevens western Michigan territory with headquarters in Grand Rapids.

Prior to joining Stevens, Pat served two years as a counter-intelligence agent

Norton

with the U. S. Army. He worked as a field engineer for Brown Instrument Division, Detroit, before being called to active duty.

Norton is a graduate of the University of Detroit with a degree in Mechanical Engineering.

J. J. Basch, former Philadelphia division manager and veteran of 28 years' service with the company, was appointed manager of research and product development, following a recent meeting of the board of directors of Oakite Products, Inc. He will be in charge of the company's

BRASS PLATING WITH TRUE BRITE

❶ improve color

❷ save labor

❸ eliminate supervision

❶ *color stays constant . . . no rejects*

❷ *eliminates frequent analyses . . .*

❸ *trouble free . . . only one addition instead of three*

Write for FREE bulletin! Your key to better Brass Plating

Available in regular 3 to 1 ratio for yellow Brass Plating.

Special ratio materials for plating richlow brass or any other desired alloy of copper and zinc.

Suitable for both still tanks and barrels.

TRUE BRITE CHEMICAL PRODUCTS CO.

P. O. Box 31, Oakville, Conn.

LATEST INFORMATION ON PROVEN METHODS FOR TREATING *CHROMIUM WASTE LIQUORS!*

A "Must" for...

Plant Engineers and Operating Men... with chromium waste disposal problems.

General Chemical's new booklet provides *sound, practical* information on the use of Anhydrous Sodium Bisulfite. For example, it contains data on:

- Properties and characteristics of Anhydrous Sodium Bisulfite
- When and how to use Batch and Continuous treatments
- Flow diagrams for chromium waste treatment plants
- Materials of construction for waste treatment plants
- Latest testing methods

If you do Chromium Plating-Anodize Aluminum-Clean Brass, etc. You Need this Booklet!

General Chemical has long been one of America's foremost producers of Anhydrous Sodium Bisulfite, with a broad and thorough knowledge of the product, its properties and uses. As such, the company has assisted many organizations in the planning of their chromium waste treatment installations using Anhydrous Sodium Bisulfite. Much useful information based on this experience has been incorporated in a new booklet now available to plant engineers and operating men who have chromium waste disposal problems. It will prove a useful guide in setting up disposal plants using Anhydrous Sodium Bisulfite.

For those who wish to explore the problem more thoroughly, the services of General Chemical's Technical Service staff are available without cost or obligation. These experts are ready to assist plant operators in overcoming difficulties with the treatment of chromium wastes from plating, aluminum anodizing and brass-cleaning operations. Possibly they can help you with your disposal problems in the same practical way they have served so many other companies.

For Technical Service—or for further information on Anhydrous Sodium Bisulfite—write or phone the General Chemical office nearest you.

Allied Chemical

Don't Delay—Write For Your Free Booklet Today!

GENERAL CHEMICAL DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 Rector Street, New York 6, N. Y.

Gentlemen: Please send me AT NO COST OR OBLIGATION your free booklet "Treatment of Chromium Waste Liquors with Anhydrous Sodium Bisulfite."

NAME_____

POSITION_____

COMPANY_____

ADDRESS_____

PL-11

Personals

expanding technical research program, and will supervise the field testing of new and experimental materials. At the same meeting, **E. H. Steif,** general attorney of the company and member of the Oakite organization since 1948, was appointed assistant secretary and elected to the board of directors. Another appointment announced was that of **W. A. Baltzell,** former southern division manager and with the company since 1941, as assistant sales manager. He will assist the general sales manager of the company's industrial division in connection with sales management functions.

Dr. William Blum, former Chief of the Electrodeposition Section of the National Bureau of Standards, has been presented with an Elliott Cresson Medal, awarded by the Franklin Institute, Pennsylvania, for distinguished contributions in the realm of physical sciences. The citation accompanying the award read: "In recognition of his long continued and unusually meritorious work in creating a modern scientific basis for the electrodeposition of metals, and for his development of useful processes in that field."

J. R. Pattenger has been named manager of the new office and warehouse facility of Crown Chemical and Engineering Co., San Francisco.

Prior to joining Crown Chemical and Engineering Co., Pattenger was with A. J. Lynch & Company fourteen years where he established and was manager of the Metal Finishing Department in San Francisco. Prior to this, he represented Charles F. L'Hommedieu & Son Co. for four years, and was connected with the J. B. Ford Wyandotte Company for six years.

Beery

His formal training in the technical field was obtained at Midwest Kansas University. Pattenger is a member of the American Electroplaters' Society.

A new technical sales engineer for the company is **Jan (Skip) Beery.** Beery received his B.S. in Chemistry from the University of Southern California in 1947. Formerly he was employed by North American Aviation, Inc., for six years as a chemical research engineer, working on experimental and development phases of electroforming, electroplating, and finishes on production aircraft.

After field training with R. O. Hull & Co., specialists in Eastern cities, Beery will return to Los Angeles well equipped to serve the countless users of Hull materials throughout California.

Roger I. Slater has been named sales representative in the Southern Ohio area by the J. C. Miller Company of Grand

Slater

Rapids, Mich. Slater, who has had wide experience in all phases of the finishing industry, has established his headquarters in Cincinnati, Ohio.

Joseph N. Kuzmick has been appointed Coordinator, Corporation Research and Development by Raybestos-Manhattan, Inc. His duties will extend to all Divisions of the Corporation and he will headquarter at Passaic, N. J. Kuzmick has

NO DOUBLE-TALK

One big advantage in doing business with an owner-managed company like ours is that you can always get a prompt, unequivocal answer to any legitimate question. Our quotations on price, quantity and delivery are as consistently dependable as the quality of BFC Chromic Acid. And that is always above the industry standard for purity.

We think you'll like the uniform quality of our product and the friendly way we do business whether the market is long or short. Why not get in touch with us when you need Chromic Acid?

EXTRA HIGH QUALITY 99.7+% PURE

CHROMIC ACID

TECHNICAL GRADE—FLAKE

BETTER FINISHES & COATINGS, INC.
268 Doremus Avenue, Newark 5, N. J.
122 East 7th St., Los Angeles 14, Calif.

been with the Manhattan Rubber Division for over thirty years during which he has been active in the development of asbestos and sintered metal friction materials, abrasive and diamond wheels, resins and plastic products.

Edward H. Rollfs has been named to the Boston and **Samuel M. Peek** and **Paul G. Lackney** to the Cleveland sales and service staffs of Wyandotte Chemicals Corporation.

Rollfs **Peek**

Rollfs graduated from Virginia Polytechnic Institute as a ceramic engineer. He completed a training program with Florence Stove and became a test research engineer for the USAAF, assigned by Wright Field. Following this, he joined the Chrysler Corporation as a project engineer. He has recently been a sales engineer covering New England and Eastern states. He is a member of the American Chemical and American Electroplaters' Societies, and will cover the Boston Area.

Lackney

Peek has sixteen years' experience selling or directing sales to industrial organizations. He has developed new industrial applications in two of his former connections. Well known in the Cleveland area, Peek has worked for Johns-Manville and Owens-Corning. He is a member of the Electrochemical Society, the National Association of Corrosion Engineers and the American Electroplaters' Society. Peek will center his activities in Akron, Canton, Mansfield and western Cleveland territories.

Lackney has had many years of sales and merchandising experience and is well known to users of industrial cleaning materials in the Cleveland area. Lackney is a member of the Foreman's Club of Greater Cleveland and the American Electroplaters' Society. He will cover the Columbus, Marion, and Toledo sections of Ohio.

Henry W. Adams has joined the Protective Coatings Division of Metalweld, Inc., Philadelphia, as a Sales Engineer.

He will service accounts with Metalweld's complete line of protective coatings and linings.

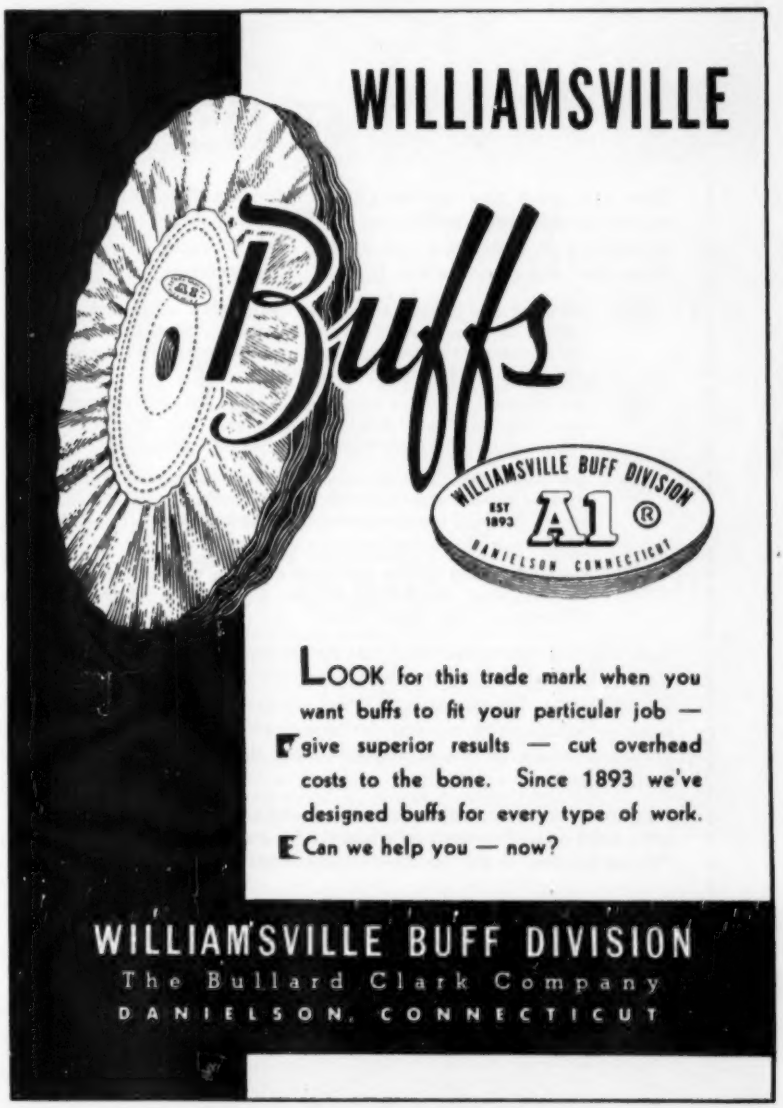
Adams was formerly regional field representative for the Amercoat Corporation.

E. F. Conroy, Jr., has been appointed Vice-President in charge of sales by the Davies Supply and Manufacturing Company of St. Louis. Conroy saw service in the tin mill metallurgical department of the Weirton Steel Company, Weirton, W. Va., prior to joining the Davies sales force in April, 1946.

Also announced was the naming of **John Kurdenok** as Chicago and Detroit representative for Davies plating racks and coatings. Kurdenok, who attended

Conroy **Kurdenok**

Illinois Institute of Technology, has wide experience in the plating field. From 1935 to 1947, he was with the Houdaille Hershey Corp., the Dodge Chicago plant and


WILLIAMSVILLE
Buffs
WILLIAMSVILLE BUFF DIVISION
EST 1893
A1 ®
DANIELSON CONNECTICUT
LOOK for this trade mark when you want buffs to fit your particular job — give superior results — cut overhead costs to the bone. Since 1893 we've designed buffs for every type of work. Can we help you — now?
WILLIAMSVILLE BUFF DIVISION
The Bullard Clark Company
DANIELSON, CONNECTICUT

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 1320.

need a finish
that blocks corrosion by
itself—or under paint?

specify
IRIDITE

You can solve any problem of non-ferrous finishing . . . maximum corrosion protection . . . sparkling clear or colored decorative finishes, firm and lasting base for paint . . . with these two words—"specify Iridite". For example—

- **ON ZINC AND CADMIUM** you can get highly corrosion resistant finishes to meet any military or civilian specifications and ranging in appearance from olive drab through sparkling bright and dyed colors.
- **ON COPPER . . .** Iridite brightens copper, keeps it tarnish-free; also lets you drastically cut the cost of copper-chrome plating by reducing the need for buffing.
- **ON ALUMINUM** Iridite gives you a choice of natural aluminum, a golden yellow or dye colored finishes. No special racks. No high temperatures. No long immersion. Process in bulk.
- **ON MAGNESIUM** Iridite provides a highly protective film in deepening shades of brown. No boiling, elaborate cleaning or long immersions.

AND IRIDITE IS EASY TO APPLY. Goes on at room temperature by dip, brush or spray. No electrolysis. No special equipment. No exhausts. No specially trained operators. Single dip for basic coatings. Double dip for dye colors. The protective Iridite coating is not a superimposed film, cannot flake, chip or peel.

WANT TO KNOW MORE? We'll gladly treat samples or send you complete data. Write direct or call in your Iridite Field Engineer. He's listed under "Plating Supplies" in your classified telephone book.

ALLIED RESEARCH PRODUCTS
INCORPORATED
4004-06 E. MONUMENT STREET • BALTIMORE 5, MD

Manufacturers of Iridite Finishes for Corrosion Protection and Paint Systems on Non-Ferrous Metals, ARP Plating Chemicals.

the General Mills Co., Minneapolis. He was Superintendent and Vice-President of the Standard Plating Rack Company for 1947 to 1951 and more recently was Vice-President of the American Plating Rack Company of Chicago.

Clay A. Sayers has been appointed by the Cowles Chemical Company, Cleveland, Ohio to serve as Cowles' technical man in the Metal Cleaner Department for the sales territory of Southern Ohio, Indiana and Kentucky.

Sayers

Sayers is well qualified to give valuable assistance to industrial metal working companies having had extensive experience in industrial selling and in the polishing and plating fields.

Howard L. Wright, Frank W. Mountain and **Thomas M. Rodgers** were named in three new appointments of sales representatives for territories along the

Wright

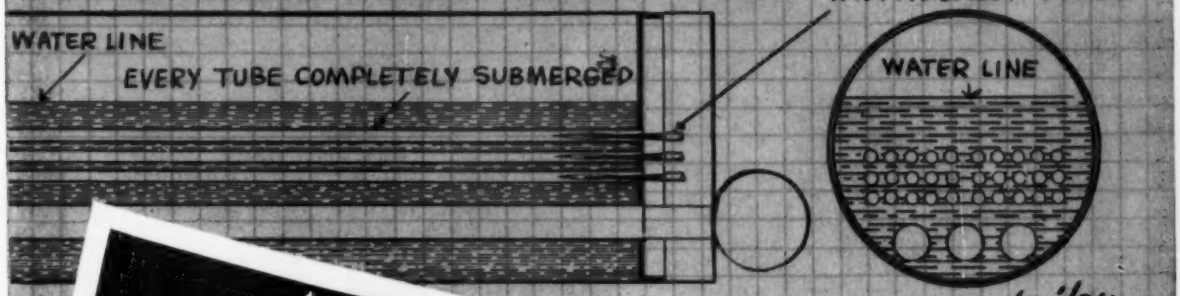
Mountain

Rodgers

middle and southeastern seaboard by Hanson-Van Winkle-Munning Co. Wright will cover the Philadelphia area, southwestern New Jersey and easternmost Pennsylvania. Assisting him will be F. W. Mountain. Rodgers takes over territory south of Wilmington.

Wright will be district manager with

when you buy a steam boiler . . . be sure to look at the picture of a Sellers Immersion Boiler



There's no other boiler like a Sellers—

every square foot of heating surface is water backed— —100% effective!

The long, individually gas fired tubes in the Sellers Immersion Boiler are all completely submerged nearer the water level—and over the return tubes! Heat is therefore uniformly distributed through them—and directly into the water—no where else!

there's no scale problem!

In immersion heating, the needed long tubes expand and contract sufficiently on intermittent firing to crack loose any hard scale that forms on the tubes. This practically eliminates the scale problem, makes maintenance simpler and increases the boiler's efficiency.

the average flue gas travel is 15 feet!

Maximum, almost complete utilization of the exhaust heat is assured with a Sellers Immersion Boiler. This is a result of Sellers exclusive design—with the firing tubes completely submerged and *located over the return tubes*, there is a long, slow flue gas travel—an average of 15 feet! Heat can only go into the water.

There's no other steam boiler like a Sellers Immersion Steam Boiler. Its simple design gives you a package boiler unit with many other outstanding features. Minimum maintenance and maximum efficiency combine to give you years of remarkably low operating costs. Twelve sizes available!

SEND FOR BULLETIN 1206 C-00
Your letterhead will bring you this tell all, dollar saving story on all 12 sizes.

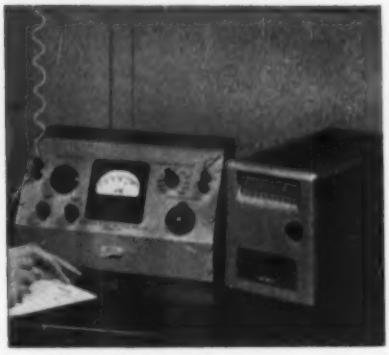
Sellers ENGINEERING CO.

4876 N. CLARK STREET CHICAGO, ILL.

Blast Heaters • Immersion Automatic Water Heaters • Combustion Units • Industrial Gas Burners
Vertical Steam Boilers • Immersion Tank Heaters • Immersion Steam Boilers

WE CUT OUR OWN ANALYSIS TIME BY MORE THAN 50%

right in our home plant!



We do a great deal of electro-plating at the Patent Button Company—not only on our own products, but also on contracts for many other firms—much of it to strict Government specifications. We plate with copper and zinc cyanide, cadmium, brass and nickel solutions.

Analyses in 20 Minutes!

Before we developed the Patwin C-1 Electro-Polarizer, we spent an average of 60 minutes in analyzing a typical solution by chemical methods. Now, with this instrument, analyses of very high accuracy are completed in 15-20 minutes! Our production has been speeded considerably, and we want to pass the news along to other electro-platers facing the same problem.

Top Quality! Low Cost!

The Patwin C-1 Electro-Polarizer needs only a standard 110 A/C outlet—comes in a steel case which takes up only 6 square feet of bench space—incorporates the finest components we're able to lay our hands on (the galvanometer, for instance, is GE's high sensitivity portable model)—and costs about $100 less than any other polaragraphic instrument we've ever heard of!

The Patent Button Company

PATWIN INSTRUMENTS Division
THE PATENT BUTTON COMPANY, Waterbury 20, Conn.

Please send me more information about your Patwin C-1 Electro-Polarizer.

NAME_____

FIRM_____

ADDRESS_____

CITY_____ STATE_____

1212 INDICATE A 1323.

Personals

headquarters in Philadelphia. With H-VW-M for seven years, Wright previously has covered Pennsylvania, New York and states in the Southeast. He is a graduate of Franklin & Marshall. Mountain moves to his new position after receiving a year's training in the company's laboratory at Matawan. He is a graduate of Colgate University, 1950.

Rodgers, whose headquarters will be in Baltimore, moves South after representing H-VW-M for the past six years in eastern Pennsylvania. He is a past president of the Philadelphia Branch of the American Electroplaters' Society, a member of the Electrochemical Society, American Society for Metals and is a registered professional chemical engineer in the state of Pennsylvania. He attended the University of Pennsylvania and Swarthmore College.

Richard F. Protiva has been named District Sales Engineer for the Heil Process Equipment Corp., Cleveland, Ohio.

Protiva **Grader**

Protiva received his Metallurgical Engineering Degree from Case Institute of Technology, and has had approximately thirteen years' experience in the sale and service of chemical process equipment in this territory.

Also recently appointed was **Ken W. Grader** as Chicago District Representative. Grader will make his headquarters at 400 W. Madison Ave., and will be able to offer immediate assistance to the many Heil customers in the steel, chemical, and electroplating industry in this area.

Grader received his chemical engineering degree from Case Institute of Technology and has had sixteen years' experience in the sale and service of chemical-proof process equipment. During the past three years he has been Sales Engineer in Heil's eastern home territory.

James H. Cogshall has rejoined the Pennsylvania Salt Manufacturing Company as a sales engineer in the Corrosion Engineering Products Department in Philadelphia after two years' service as a Lieutenant Commander in the Navy.

Cogshall previously served as a corro-

Available for Immediate Shipment, Attractive Values

THE FOLLOWING EXCELLENT REBUILT AND GUARANTEED ELECTROPLATING MOTOR GENERATOR SETS AND RECTIFIERS, WITH FULL CONTROL EQUIPMENT:

PLATERS

1—7500/3750 AMPERE, 6/12 VOLT, **MUNNING** "OPTIMUS."
1—6000/3000 AMPERE, 6/12 VOLT, **BOGUE**, Synchronous.
1—5000/2500 AMPERE, 8/16 VOLT, **ELECTRIC PRODUCTS**, 25° C., Synchronous, Exciter-in-head.
1—5000/2500 AMPERE, 9/18 VOLT, **COLUMBIA**.
1—5000/2500 AMPERE, 7/14 VOLT, **CHANDEYSSON**, 25° C., Exciter-in-head.
1—5000/2500 AMPERE, 6/12 VOLT, **CHANDEYSSON**, 25° C., Synchronous, Exciter-in-head.
1—4000/2000 AMPERE, 6/12 VOLT, **CHANDEYSSON**, 25° C., Synchronous, Exciter-in-head.
1—3000/1500 AMPERE, 6/12 VOLT, **ELECTRIC PRODUCTS**, Synchronous, Exciter-in-head.
1—3000/1500 AMPERE, 6/12 VOLT, **COLUMBIA**, Synchronous.
1—2000/1000 AMPERE, 8/16 VOLT, **ELECTRIC PRODUCTS**.
1—2000/1000 AMPERE, 6/1 2 VOLT, **HANSON-VAN WINKLE-MUNNING CO.**
1—1500/750 AMPERE, 6/12 VOLT, **H-VW-M**, Synchronous, Exciter-in-head.

ANODIZERS

1—4000 AMPERE, 40 VOLT, **CHANDEYSSON**, Exciter-in-head.
1—1000 AMPERE, 30 VOLT, **IDEAL**, Exciter-in-head.
1—1000 AMPERE, 40 VOLT, **CHANDEYSSON**, 25°C.
1—500 AMPERE, 25 VOLT, **CHANDEYSSON**, Synchronous, Exciter-in-head.
1—400 AMPERE, 40 VOLT, **M. G. C.**, Exciter-in-head

RECTIFIERS

BRAND NEW BASIC RECTIFIERS, 1500/750 amperes, 6/12 volts. Special Price: $750.00 each. Separate Voltage Controls available.
1—2000 AMPERE, 6 VOLT, **G. E.** COPPER OXIDE, and Control.
1—**GREENS ELECTOPLATER**, 1800 AMPERE, 12 VOLT, 220/3/60.
1—**UDYLITE-MALLORY**, 1500/750 AMPERE, 6/12 VOLT, and Control.

SPECIAL

1—**MERCIL** 12 x 12 CENTRIFUGAL DRYER, Electric Heat.
1—**KREIDER** 12 x 12 CENTRIFUGAL DRYER, Steam Heat.
1—**CROWN** 18 x 18 CENTRIFUGAL DRYER, Steam Heat.
4—24" and 30" **ROBBINS & MYERS** 2-SPEED VENTILATING FANS.
3—**NO. 1 HARTFORD TRIPLE-ACTION** BURNISHING BARRELS, Lined and Unlined, Belted.

Above is partial list only. Write to us for all your requirements for Plating, Anodizing and Metal Finishing

WIRE—PHONE—WRITE

M. E. BAKER CO.

25 WHEELER STREET
Kirkland 7-5460 **CAMBRIDGE 38, MASS.**

PROMAT CHROMATE PROTECTIVE COATINGS for ZINC SURFACES...

PROSEAL No. 1 and 3—Brightening and protection of plated zinc at its maximum efficiency ...always sealed by Proseal 2-A or 2-B... heavy fixed chrome deposit with minimum iridescence ... double immersion.

PROSEAL 6—Ready-to-use process... dilute to strength and start operation ... no acid addition required. Produces a mirror-bright finish over plated zinc when subsequently sealed... yellow or bronze finish over plated zinc is also obtainable ... very inexpensive.

PROSEAL 2080—Dark film of low reflecting power... high corrosion resistance ... meets all specifications for chrome-type protective films ... inexpensive and very workable.

PROMAT D-32-A—Inexpensive means of producing brilliant protected surfaces on plated zinc ... used as a final finish.

PROSEAL 9—Dry chromate to which only water and acids are added... inexpensively producing a mirror-bright finish over plated zinc or cadmium when subsequently sealed or leached... olive drab and bronze finish are also obtainable.

... other protective coatings described in brochure.

BETTER PRODUCTS don't just happen. They're the result of intensive research and testing. That was the case with Promat Chromate Protective Coatings for zinc surfaces. They were seven years in the lab and field, being developed and tested.

That's why we can say Promat Chromate protective coatings are equal to, or excel, any product offered for a similar purpose ... and you can believe it.*

Promat protective films are unique, "open" process treatments. Full analytical procedures for maintaining the solutions are published. You get more "mileage" as a result, and the films produced are unusally uniform. All the Promat Chromate Protective coatings listed, left, can be used on cadmium deposits as well as zinc. Write today for brochure describing the complete Promat line of plating supplies.

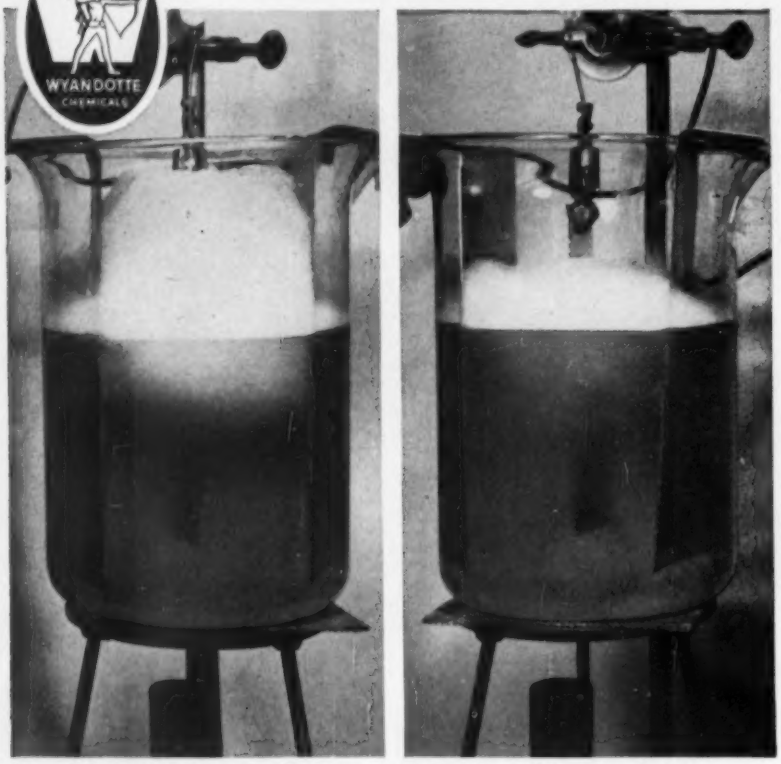
**Promat has the finest demonstration lab in the metal finishing trade. We're always glad to process any samples submitted to us.*

PROMAT

DIVISION **POOR & COMPANY**
851 S. Market St., Waukegan, Illinois

INDICATE A 1325.

Specialists in Industrial Cleaning Products



Comparative foaming test. At left, Wyandotte F.S., prior to latest formula improvement, has average foaming characteristics for a heavy-duty electrocleaner used at a high current density. At right, in the same test at the same high current density, foaming of improved F.S. is greatly reduced. This minimizes explosion possibilities in high-conductivity electrocleaners, as well as problems due to excessive foam carried out on parts.

Improved Wyandotte electrocleaners are non-dusty and cut foam formation 50%!

Now Wyandotte's three great electrocleaners, F.S., B.N. and No. 90 are even better than ever!

Excellent performance characteristics of all three are unchanged! Dustlessness minimizes coughing, sneezing, skin irritation — foam is reduced as much as 50%!

For better electrocleaning at lower cost, use the best electrocleaners on the market: F.S.* for all around heavy-duty anodic steel cleaning: B.N. for versatile direct and/or reverse cleaning of non-ferrous metals; No. 90 for anodic steel cleaning where smuts and/or chrome contamination are particularly troublesome.

Ask your Wyandotte metal cleaning specialist to demonstrate improved F.S., B.N. or No. 90 to you. *Wyandotte Chemicals Corporation, Wyandotte, Michigan. Also Los Angeles 12, California.* * Reg. U.S. Pat. Off.

CLEANING THE WORLD

Largest manufacturers of specialized cleaning products for business and industry

Wyandotte CHEMICALS

Helpful service representatives in 138 cities in the United States and Canada

Personals

sion engineer at Pennsalt's Wyandotte, Mich., plant, where he supervised a study of the use of protective coatings in Pennsalt's plants.

He is a member of the American Chemical Society and the National Association of Corrosion Engineers.

Richard L. Mullaney, Jr., has been appointed a senior chemist by the Apothecaries Hall Co. of Waterbury, Conn. He will assist in the development of metal finishing specialties and also will be avail-

Mullaney

Brazanskas

able for technical service work related to metal finishing problems. Mullaney is an honor graduate in chemistry from St. Anselm's College. Before joining Apothecaries Hall he had been a plating chemist with Pratt & Whitney Aircraft and a plating supervisor and chemist at the Trumbull Electric Co.

Algird J. Brazanskas has been named an assistant chemist by Apothecaries Hall. He will work on research and development problems in metal finishing. Brazanskas is a graduate of the University of Connecticut where he majored in chemistry. He is a member of the American Chemical Society.

Harry Hariton, of Forest Hills, N. Y., has been appointed Sales Representative of Wagner Brothers, Inc., Detroit, for the New York Metropolitan area.

He will cover New York City, Long Island and Northeastern New Jersey.

Hariton

Hariton, a Chemical Engineer, was formerly Sales Manager of Empire Plating Co.

In another announcement by the com-

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 1326.

pany, **Theodore C. Smolinski** was appointed Director of Technical Service. Since his graduation from Michigan State College in 1942 with a B.S. degree in Chemistry, he has worked on plating and chemical problems for Oldsmobile, Packard and Ainsworth Manufacturing. He joined Wagner Brothers in June of this year.

Promotion of two veteran executives to vice-presidencies and formation of two new autonomous divisions in Diamond Alkali Company have been announced.

W. H. McConnell, Director of Sales, has been elected Vice-President, Sales. **C. E. Lyon,** Works Manager of Diamond's electrochemical plant at Houston, Tex., also becomes a Vice-President.

Also announced was the formation of two new autonomous divisions: the Plastics and Agricultural Chemicals Division with **A. L. Geisinger,** a vice-president, as general manager of the division; and the Chromium Chemicals Division with **Frank W. Jarvis** as general manager. Jarvis since 1951 has been president of Diamond Magnesium Co., a subsidiary of Diamond Alkali.

Obituaries

Lloyd S. Burns, Vice-President and Secretary of E. Reed Burns Manufacturing Corporation, died on Wednesday, August 5, 1953.

J. J. Siefen, President of the J. J. Siefen Company, Detroit, died on August 23, 1953 at his home in Detroit at the age of 78.

Siefen formed the company bearing his name in 1927 as a jobber of plating and polishing supplies and equipment. He learned his trade in Germany and after coming to this country at the age of 16, became foreman of a brass plating shop at 19. Thereafter followed years as supervisor, factory manager and general manager in various metal finishing factories until 1927.

Siefen was active in the business until shortly before his death. He had changed it into a manufacturing concern of buffing and polishing materials, the most noted development being the successful practice of spraying buffing and polishing compounds.

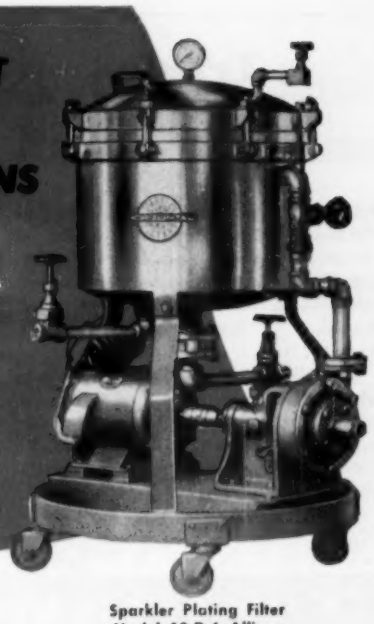
He was a member of the Detroit Branch of the American Electroplaters' Society.

Littleton C. Barkley, 51, General Sales Manager, West Coast Division of Raybestos-Manhattan, Inc., died on August 27, at San Mateo, Calif.

Barkley joined the Manhattan Rubber Mfg. Co., Passaic, N. J., now the Manhattan Rubber Division of Raybestos-Manhattan, Inc., in 1926. He was appointed Sales Manager of the Industrial Rubber Products Division at Passaic in 1944. In 1948 he assumed his duties on the Pacific Coast.

FOR LOW COST FILTERING OF PLATING SOLUTIONS

SPARKLER HORIZONTAL PLATE FILTERS



Sparkler Plating Filter
Model 18-D-6 Alliron
600 G.P.H. Portable

HERE'S HOW

★ On a horizontal filter plate it is possible to apply a thin pre-coat with about one-third the filter aid, and in one-third the time required for pre-coating a non rigid media or a surface in a vertical position. This saves time and filter aid.

★ With the Sparkler horizontal plate you can apply this thin pre-coat evenly over the entire plate surface and start filtering immediately with less pressure and obtain maximum consistant clarity right from the start up to the end of the cycle.

★ A filter cake on a horizontal plate will not crack, slip or fall off even with varying pressure or a complete shut-down of the filter. No pre-coat renewal is ever required after an interruption in operation.

★ When it is necessary to clean the filter, the Sparkler filter tank can be emptied in a matter of minutes with a minimum of loss of valuable plating solution.

★ Any grade of filter paper from fine to coarse can be used in a Sparkler filter. This makes it ideal for carbon treatment of solutions. Carbon mixed with water in a stand-by tank is circulated through a clean set of filter paper on the plates until a carbon cake is formed. The solution requiring carbon treatment is then circulated through the carbon beds without contaminating the plating tank or a shutdown of plating operations.

★ At the end of the cycle with a Sparkler filter you can blow-down with air and produce a relatively dry cake that can be disposed of in a trash can rather than washing it down the drain with attendant sewer clogging problems.

★ You will find your Sparkler plating filter positive and dependable from a standpoint of uniform high quality filtering and economical in labor and material.

SPARKLER

Sparkler representatives in all principal cities are ready to give you personal service on your filtering problems, and show how you can make a material saving in operating cost.

MANUFACTURING COMPANY
Mundelein, Illinois

Sparkler International Ltd.
Prinsengracht 876, Amsterdam, Holland

Sparkler Western Hemisphere Corp.
Mundelein, Ill. U.S.A.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 1327. 1215

Trade Literature

L—1100. Installation and Care of Packings—A comprehensive catalog on the proper installation and care of packings has been published by the mechanical goods division of the United States Rubber Co., Rockefeller Center, New York 20, N. Y.

In addition to information concerning what packings should be used on various installations, the catalog contains metric engineering tables and Centigrade and Fahrenheit conversion charts. There is also helpful material on maintenance for rod and plunger packings and gaskets. A complete chart is included on the chemical resistance of gasket materials as well as tables on melting points and specific gravity of various materials. For your copy use Reader Service Card.

L—1101. Heavy Zinc Phosphate Coating for Steel—Oakite Products, Inc., 19P Rector St., New York 6, N. Y., have announced the publication of a new booklet, "How To Apply Better Zinc Phosphate Coatings to Steel in Preparation for Painting", which describes the recently developed Oakite CrysCoat HC process.

This 12-page booklet gives a concise, clear-cut explanation of the problems involved in securing lasting paint adhesion on steel, and in protecting painted surfaces from electrochemical corrosion. It describes the action of Oakite CrysCoat HC in coating steel surfaces with a heavy zinc phosphate film which exceeds the requirements of U. S. government specifications. Photographs showing the results of standard salt spray tests on treated and untreated steel panels, and drawings illustrating both corrosion and the anti-corrosive action of Oakite CrysCoat HC are among the many illustrations. For your copy of the booklet, use Reader Service Card.

L—1102. Instrument Booklet—"Instruments for Modern Measurements" is the title of a new 34-page book published by Brush Electronics Co., 3405P Perkins Ave., Cleveland 14, Ohio. It illustrates and describes over 37 different instruments especially engineered and produced for: electrical, physical, resistance-welding, textile, electro-acoustical measurements, and ultrasonic energy applications. Several new instruments are included as well as improved models. For your copy of this new book use Reader Service Card.

L—1103. Pamphlet on Clad Metal—A new pamphlet describing nine new developments has been announced by Knapp Mills, Inc. of New York.

The new pamphlet gives detailed information on the following: Lead cladding on high conductivity copper for anode applications; hard-chromium plating of large and irregular objects which were formerly considered impractical; lead cladding on carbon steel. For your copy of the pamphlet use Reader Service Card.

L—1104. Soniclean Process Bulletin—The Detrex Corporation, Detroit 32, Mich., has announced the publication of a special technical folder on its new Soniclean process, the application of ultrasonic energy for the cleaning of metal parts.

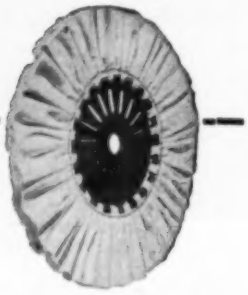
Illustrated by appropriate graphs and diagrams, the folder describes in considerable detail the principles and methods used in the new Detrex process. In the folder, the process is described as a "properly engineered combination of the solvent degreasing cycle and the application thereto of ultrasonic energy to produce the ultimate in precision metal cleaning". For your copy of the bulletin, use Reader Service Card.

L—1105. Wet-Blasting Literature—Complete information on deburring, die and mold polishing, blending grind lines, scale removal, honing of cutting tools and pre-plating, cleaning with both regular velocity and high velocity pressure blast wet-blasting equipment is now available in a new, fully illustrated, eight-page booklet issued by the Cro-Plate Company, Inc., 747P Windsor St., Hartford 5, Conn. Dozens of before and after photographs depict actual case histories and sections of the booklet are devoted to automatic,

A FEW OF THE MANY
FORMAX
PRODUCTS

STYLE C-20
CONTACT WHEELS
and F-26 Belt Lubricant

A C-20 flexible Contact Wheel will form itself to the shape of the work and permit the abrasive belt to polish contoured surfaces and F-26 Abrasive Belt Lubricant will increase belt life by preventing loading and glazing. Produces finer, smoother and brighter surfaces through lubrication.



ZIPPO BUFFS

These famous long-wearing buffs run cool under all buffing conditions. Constructed of high count bias-cut cloth or sisal mounted on safe steel centers. Available in a wide range of densities and center diameters.

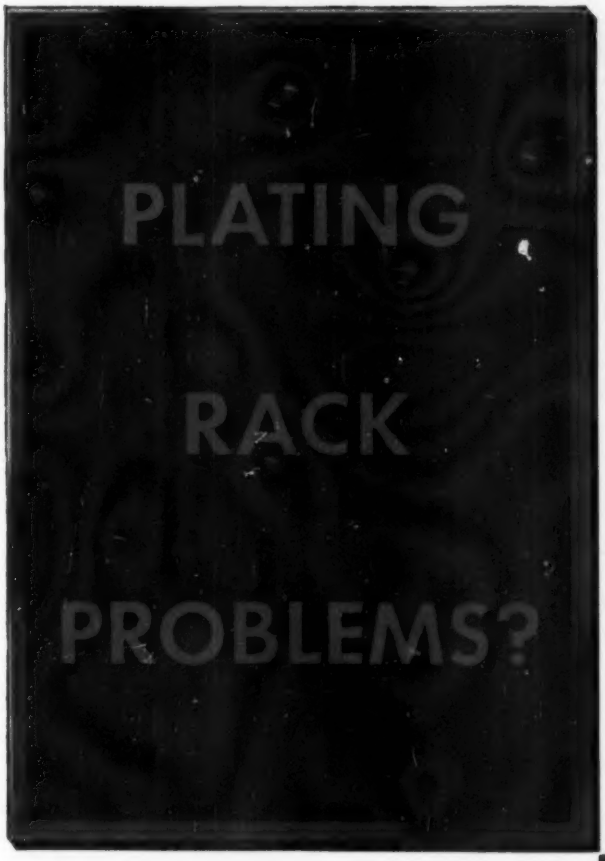
A complete line of buffing compounds in bar form as well as in liquid form for brush or spray application. Also Flex-A-Glu polishing wheel cements.

Our Laboratory and Sales Engineering staff would welcome the opportunity to be of help in solving your finishing problems.

Send for descriptive literature

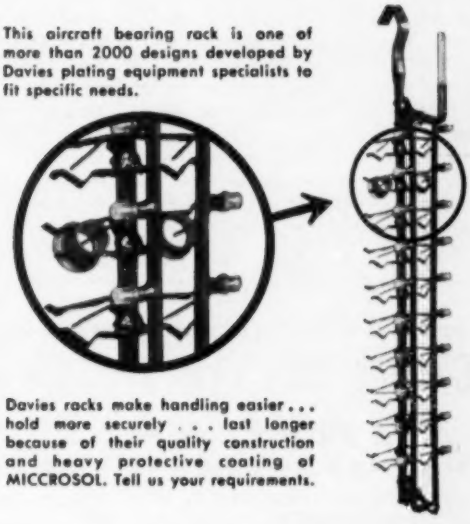
FORMAX MFG. CORP.
DETROIT 7, MICHIGAN
"THE FOUR McALEERS"

MANUFACTURED IN CANADA BY JOHN GALLOWAY LTD., KITCHENER, ONT.



Davies Custom Made Plating Racks will come to your aid . . .

This aircraft bearing rack is one of more than 2000 designs developed by Davies plating equipment specialists to fit specific needs.



Davies racks make handling easier . . . hold more securely . . . last longer because of their quality construction and heavy protective coating of MICCROSOL. Tell us your requirements.

WRITE TODAY FOR COMPLETE DETAILS

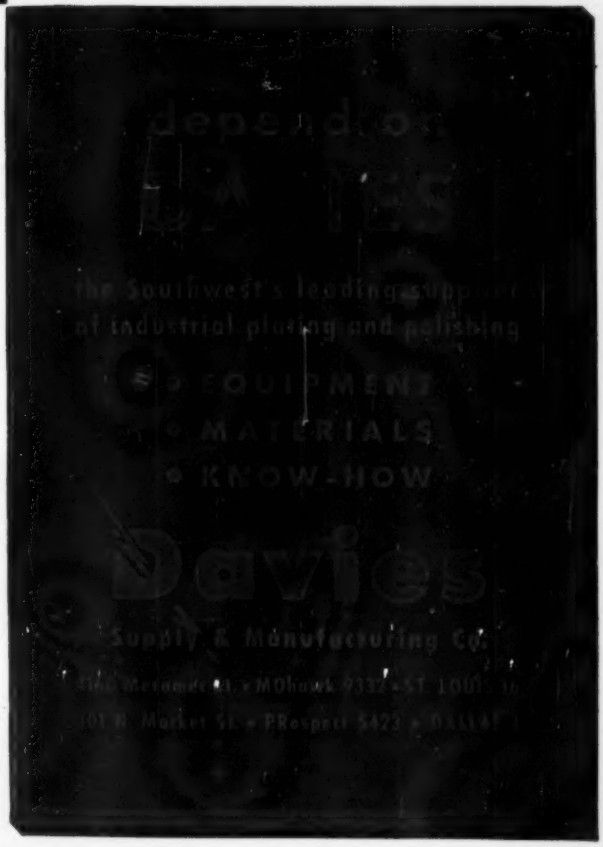
LET Davies SERVE YOU

OUR SERVICE COVERS THE GREAT SOUTHWEST

Davies is southwestern sales and service representative for the "blue ribbon" firms of the plating and polishing industry.

- THE UDYLITE CORPORATION
- FREDERICK B. STEVENS, INC.
- MacDERMID, INC.
- ALLIED RESEARCH PRODUCTS (Iridite)
- ALMCO DIVISION, QUEEN STOVE WORKS
- METALWASH MACHINERY CORPORATION
- INDUSTRIAL ELECTROPLATING CO. (Niehaus Fume Separators)
- R. O. HULL AND COMPANY
- CIRCO EQUIPMENT COMPANY
- ALROSE CHEMICAL COMPANY (Jetal Process)

—and many others



FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 1329.

Trade Literature

high-production rate machines, abrasives and metal-gard, a new rust preventative to be used following wet-blasting operations. For more information on this literature, use Reader Service Card.

L—1106. Plating Anodes Catalog—A new eight-page, illustrated catalog published by Federated Metals Division, American Smelting and Refining Company, 120P Broadway, New York, N. Y., provides full information on copper, lead, zinc, tin, tin-lead, cadmium, and brass plating anodes.

Data on sizes, shapes, compositions, and other characteristics are included in the catalog to make easy the ordering of the proper anode for any kind of job. Prominent among the many anode types described is the exclusive Conducts-Core lead anode for heavy-duty decorative or hard chromium plating. For your copy of the catalog, use Reader Service Card.

L—1107. Micro-Polish Bulletin—The Murray-Way Corporation, P. O. Box 180P, Birmingham, Mich., have issued a new Micro-polish brochure. This informative, 10-page brochure gives a complete description of micro-polish units for polishing coils, blanks, and sheets of steel, brass, aluminum, rubber, etc. For your copy of this helpful and informative literature, use Reader Service Card.

L—1108. Barrel Finishing Process Booklet—The Supersheen process is detailed in a newest publication, "Advanced Speed Finishing", issued by the Queen Stove Works, Inc., Almco Division, Albert Lea, Minn. Much of the information contained in this booklet represents years of research and development and has heretofore remained unpublished and somewhat "under cover". The 52-page booklet has been published primarily to introduce the trades to the newest, most economical way to handsomely improve the finishes of their products and solve their finishing problems. For your copy, use Reader Service Card.

L—1109. Metal Processing Catalog—Klem Chemicals, Inc., 14401P Lanson Ave., Dearborn, Mich., announces a new catalog for use by metal processors and finishers to aid in selecting correct chemicals for various operations. The catalog lists 33 standard Klem products and contains a comprehensive application chart for surface preparation of ferrous and nonferrous metals. For your copy, use Reader Service Card.

L—1110. Hand Pyrometer Bulletin—A new bulletin on the General Electric Type FH-1 hand pyrometer has been announced as available from the company, Schenectady 5, N. Y.

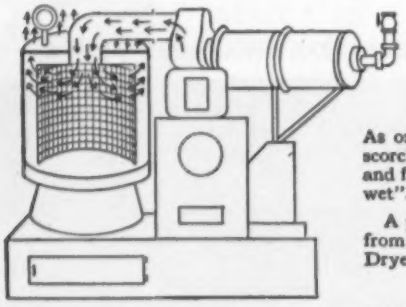
The 4-page booklet contains information on the uses and applications for the portable instrument which measures temperature of any surface, liquid, gas or molten metal from 0 to 1500° F. Specification and accessory information also is provided. For your copy of the bulletin, use Reader Service Card.

L—1111. Rectifier Bulletin—Accurate Engineering Company, 2005P Blue Island Ave., Chicago 8, Ill., have issued a new bulletin pertaining to the new line of Accurate selenium plating rectifiers. The new line includes a unit for every possible requirement or choice—self-contained rectifiers with controls built-in; basic rectifiers where no voltage regulation is necessary; remote control type consisting of a basic unit and separately housed controls; anodizing rectifiers; bench mounted economy models in lower amperages; and special units designed, engineered, and custom-built for any unusual or complex individual application. Output voltages range from 6V to 48V, constant or variable, in current ratings of from 10A to 5000A. For your copy of the bulletin, use Reader Service Card.

L—1112. Acid Proof Coatings—New literature covering Duro-kote and Duro-kote 57 acid-proof coatings has been issued by the Electro Chemical Engineering & Mfg. Co., 750P Broad St., Emmaus, Pa. These materials give the highest type of vinyl and butadiene styrene acid-proof resin protection against acids, alkalies, and many solvents.

Duro-kote and Duro-kote 57 are planned primarily as acid-proof and alkali-

EVER BLOW INTO AN ASH TRAY?

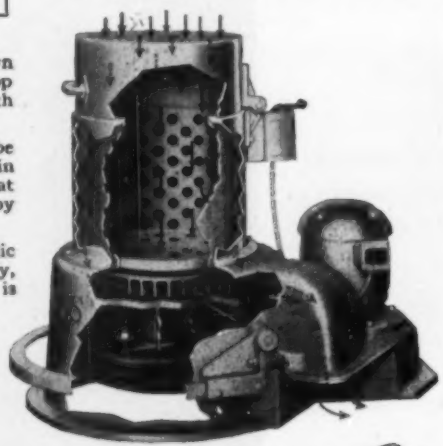


If you did, you saw a practical demonstration of the principle of air deflection. In old type dryers, air *blown* in from the top is deflected by the top layer of parts. As one user put it, "the top layer gets scorched, the next layer is nice and dry, and from there on down the parts are still wet".

A powerful suction fan *draws* the air from the bottom of the modern Nobles Dryer. Fresh air rushes in from the top to fill the vacuum and is drawn through the entire contents from top to bottom where it is expelled with the water.

Steam or electric heaters may be mounted compactly in the cover in contrast with space consuming, heat wasting, separate units connected by pipe.

An internal expanding, hydraulic brake stops the machine smoothly, and quickly. The "brake pedal" is a ring extending around the entire working area so that the machine can be stopped instantly from any working position. In the interest of faster drying and lower costs write today!

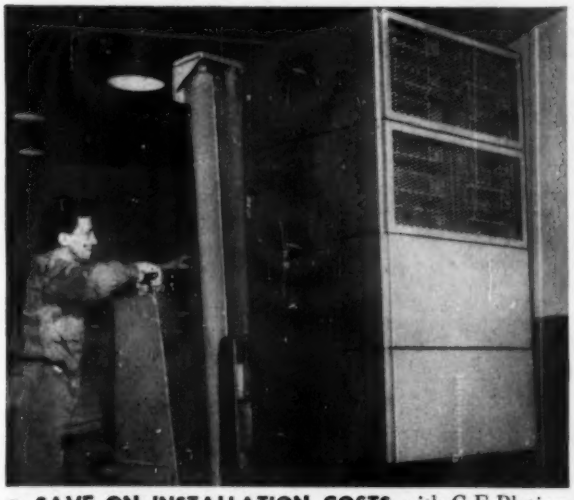


NOBLES ENGINEERING & MANUFACTURING CO.

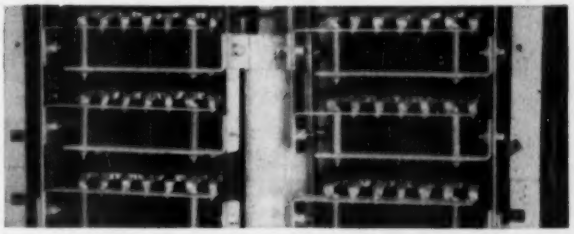
[illegible] SEVENTH STREET ST. PAUL 6, MINNESOTA

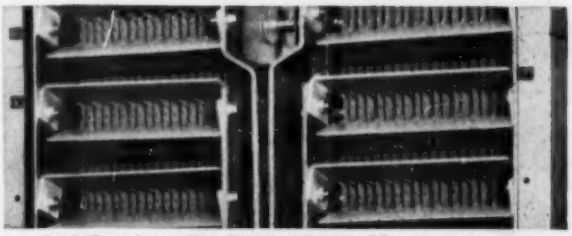
WRITE FOR **FREE Folder**

You Save Four Ways with G-E Plating Power Supplies



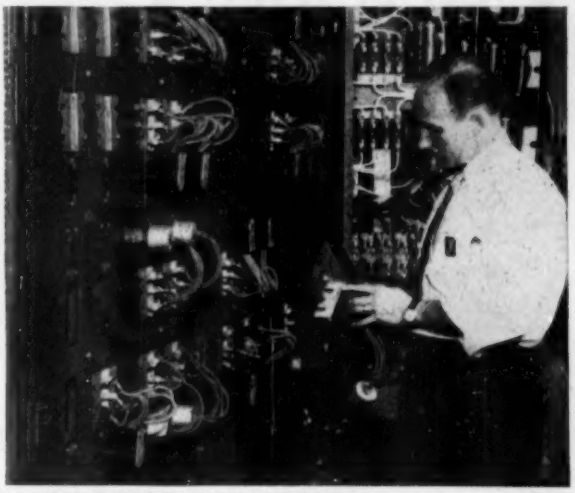
1 SAVE ON INSTALLATION COSTS with G-E Plating Power Supplies. No special foundations are required. Simply move rectifier unit into place with a fork truck, make connections, and it's ready to operate.





2 SAVE ON OPERATING COSTS. Maximum operating economy is obtained in every rating of G-E Plating Rectifiers by using either copper-oxide (top) or selenium (bottom) rectifier cells at their most efficient voltages.

3 SAVE ON MAINTENANCE COSTS. A cooling fan, requiring occasional lubrication, is the only moving part. All parts are corrosion resistant. Cooling design minimizes intake of dirt, dust and corrosive fumes.



4 SAVE ON EQUIPMENT LIFE. At rated output G-E copper-oxide rectifier stacks last almost indefinitely. On test stands G-E selenium rectifier stacks have maintained rated output for over 60,000 hours.

General Electric Plating Power Supplies are available for laboratory plating, barrel plating, and with manual or automatic regulation. For more information contact your nearest G-E Plating Rectifier agent or G-E Apparatus Sales Office, or write Section 464-13, General Electric Company, Schenectady 5, N.Y.

You can put your confidence in—

GENERAL ELECTRIC

Trade Literature

proof maintenance paints useful in metal finishing, chemical, metallurgical and electrometallurgical plants. For your copy of this new literature, use Reader Service Card.

L—1113. "Soft" Metal Deburring—Two standard Maizo Blast machines for the production deburring of a variety of "soft" metal parts are described in a bulletin issued by Modern Industrial Engineering Co., 14230P Birwood Ave., Detroit 4, Mich. Since 60 to 80 psi air pressure is needed for the blasting operation, normal plant air is all that is needed.

Descriptions and specifications of both production models are included in the bulletin. Model Ma-24 is a continuous operating machine with a ferris-wheel type fixture for holding small parts made of aluminum or other soft metals. Model MA-1 is a stationary unit for larger parts. For your copy of the descriptive bulletin, use Reader Service Card.

L—1114. Package Water Conditioner—A package water conditioning plant, an extremely versatile and self-contained unit, designed to chlorinate, coagulate, clarify, filter, neutralize, de-alkalize and soften raw water supplies is graphically described and illustrated in a new eight-page bulletin, prepared by the Permutit Company, 330P W. 42nd St., New York 36, N. Y. It lists the component parts of the complete water conditioner, details the principles of operation, gives ratings, capacities and sizes and illustrates some typical installations. For your copy, use Reader Service Card.

PERMAG
FOR
CLEANING
WHITE
METALS
PERMAG
If you have trouble with:
BUFFING COMPOUND
REMOVAL, SAFE
ANODIC CLEANING,
METAL WASHING
MACHINE COMPOUNDS,
OR SOAK CLEANING
— let us help you.
The right electrolytic cleaning compound for whatever purpose you may need is assured when you use a PERMAG cleaning compound.
While extremely adaptable to the various finishing processes, PERMAG compounds are designed to do a particular job.
White metals, whether for electrodeposition or other finishing, always come clean under PERMAG treatment. Our technical service staff will be glad to make recommendations on any cleaning problem you may have.
Write for your FREE Electroplaters Handy Pocket Size Manual on Cleaning Compounds.
MAGNUSON
PRODUCTS CORPORATION
50 Court Street • Brooklyn 2, N. Y.
In Canada:
CANADIAN PERMAG PRODUCTS, LTD., MONTREAL

L—1115. Dial Thermometer Bulletin—A new 16-page bulletin, describing dial thermometers for long distance measurements, has been issued by The Foxboro Company, Foxboro, Mass. Emphasizing the variety of ranges, and the bulbs, tubing and accessories available, the bulletin provides complete data on temperature indicators of the vapor pressure and gas pressure types. A separate section gives details of construction. Diagrams show suggested installation methods. For your copy of the new bulletin, use Reader Service Card.

L—1116. Products List—A new 4-page booklet, containing a list of 37 dispersions of colloidal graphite, molybdenum disulfide, vermiculite, and zinc oxide, has been issued by the Acheson Colloids Co. Included are three electrically conductive coatings, No. 183, No. 184, No. 194. Typical applications, densities, carriers, and other important data are given.

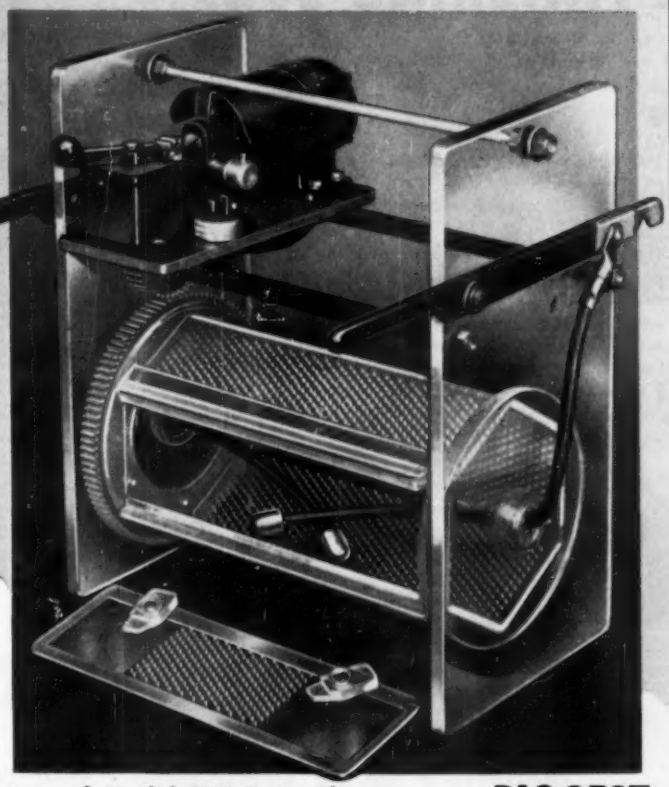
Copies of "A List of 'dag' Dispersions for Industry" are available free of charge and may be obtained by writing to Acheson Colloids Co., Div. of Acheson Industries, Inc., Port Huron, Mich., or by use of Reader Service Card.

L—1117. Folder Describes Uses, Benefits of Metallizing—A new, 4-page, 2-color, illustrated folder on the application of, uses for and benefits to be obtained with metallizing has recently been published by the Protective Coatings Division of Metalweld, Inc., Scotts Lane and Abbottsford Ave., Philadelphia, Pa. Included is a section entitled "What The Metallizing Process Can Do For You" that contains photos, drawings and descriptive copy on the many applications throughout industry for metallizing. The folder also contains a description of the process itself as well as important data on a new spraying technique which saves considerable time and permits work on jobs that could not be done before. For your copy, use Reader Service Card.

L—1118. Steam Generator Heat Recovery and Process Equipment Catalog—A new 20-page condensed catalog, now being circulated by Union Iron Works, Erie, Pa., covers concisely their diversified line of steam generators and allied equipment.

Described are eight basic arrangements of two, three and four drum steam generators furnished to meet a wide range of loads, pressures and temperatures for power, process and space heating; heat recovery units, including fire tube and water tube boilers, plain tube and cast iron extended surface economizers; Union process equipment including Dowtherm vaporizers, reaction kettles, autoclaves, heat exchangers and liquid heaters. For your copy of the catalog, use Reader Service Card.

Belke New LUCITE PORTO-PLATER



only $167.50

with 9x15" O.D. Cylinder
115 V, 60 C, 1 Ph. Motor

also
14x30 and 14x36 Plating Barrels and full Barrel Cycle Lines at very reasonable prices!

Ask your BELKE Service Engineer or write.

Features of Model SPX Porto-Plater

Notched "V" Cathode Contact fits Cathode Rod at any point on the rod.

Complete Lucite End Plates — Support plater — protect cylinder and mechanism in handling.

Reversing Switch with self-contained motor drive —Motor turns cylinder in either direction and holds positively for loading and unloading.

Obstruction-free Cylinder—One-piece molded High Temperature Lucite shell welded to cylinder ends. No ribs, no tie rods, no crevices.

Attached Lucite Cover Locks — Always on the cover. Never misplaced or dropped in tank.

Ball Contact with one-piece dangler cable.

High Temperature Lucite—Cylinder, cover, cover locks, hangers, gears and bushings.

Cylinder perforations 3/32" unless specified.

Cylinder, O.D. 9x15"; I.D. 6x12".

Weight Empty, 28 lbs. Plating Capacity, ¼ peck.

Geared head motor, 1/50 HP, 115 V, 60 C, 1 Ph.

BIGGEST VALUE ever produced in a LUCITE PORTO-PLATER

New features and low price, made possible by BELKE BIG VOLUME PRODUCTION, add up to TREMENDOUS VALUE far greater than ever before obtainable.

A flood of orders in excess of production has created a big backlog with extended delivery dates.

To avoid disappointment, please order well in advance of your needs. Deliveries must be scheduled on the basis of first come first served.

Belke Manufacturing Company
947 N. Cicero Ave., Chicago 51

EVERYTHING FOR PLATING PLANTS

Always Looking For-

BIGGER, TOUGHER or FINER, DELICATE METAL FINISHING JOBS

LEA compound

Industry's No. 1 Greaseless Composition

For *BIG, ROUGH, TOUGH* metal finishing jobs, or for *SMALL, DELICATE, PRECISION* finishing jobs, LEA Compound is just the ticket! This greaseless composition is perfect . . . perfect for achieving a satin finish . . . perfect for polishing . . . perfect for buffing . . . perfect for burring. What is your metal finishing problem? Whatever it is, our technical staff and our lab can work out a clean, economical method for you. Why not write to us now. . .

The LEA Finishing Family

LEAROK • LEA LIQUABRADE • AD-LEA-SIVE • LEABRAMENT • LEA SPRAY GUN MOVER
LEA LIQUALUBE • cLEAn GRAIN LUBAR • LEA LAPPING PASTE
LEA GRIPMASTER • LEA LUBAR

LEA GRIPMASTER® POLISHING WHEEL CEMENT, matching the high quality of other Lea Products, is now available through Lea-Michigan, Inc., 14066 Stansbury Avenue, Detroit 27, Michigan.

THE LEA MANUFACTURING CO.

16 Cherry Ave., Waterbury 20, Conn.

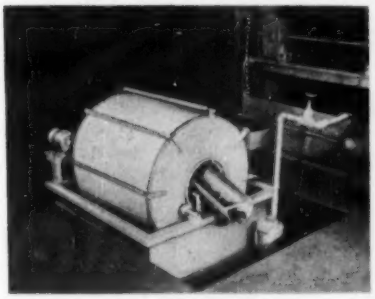
LEA-MICHIGAN, INC.
14066 Stansbury Avenue
Detroit 27, Michigan

LEA MFG. COMPANY OF CANADA, LTD.
370 Victoria Street
Toronto 2, Canada

LEA-RONAL, INC.
42-48 27th St.
Long Island City, N. Y.

Equipment and Supplies

E—1119. Automatic Filter—The Murray-way Corporation of Birmingham, Mich., announces the development of a revolutionary, new automatic filter for all types of industrial filtration.



The new Murray-Way Filter automatically rotates fresh filtering area into position while simultaneously ejecting contaminant cake. Filtering screen material and size of screen opening can be supplied in monel, stainless steel, brass or bronze to fit all requirements.

The new filter is unusually efficient and economical. It eliminates costly consumption of throw-away filtering media since the wire filtering screen has many times the life of the finest cloth filtering webs.

Built to conserve valuable floor space, this compact unit offers unusually great filtering capacity in proportion to floor area occupied. For more information on these filters, use Reader Service Card.

E—1120. Hi-temp Masking Tape—A new pressure-sensitive tape for high heat masking use by aircraft and electronic manufacturers on such treated metals as anodized aluminum, pickled steel, and dichfomated magnesium is announced by Minnesota Mining and Manufacturing Co., 900P Fauquier St., St. Paul 6, Minn.

The new tape, "Scotch" brand high temperature masking tape No. 214, is expected to find widespread use by aircraft assembly, engine, and parts manufacturers, as well as throughout the entire metal finishing trade.

It is designed for masking use in oven temperatures up to 325° F, and is capable of withstanding "much longer bake cycles than previously possible". Laboratory and field tests show that the tape can be used in oven cycles even as high as 375° F, and at room temperatures as well. For more information on the new tape, use Reader Service Card.

E—1121. Recording Turbidimeter—A new recording turbidimeter, which continuously and automatically measures and permanently records the number of particles suspended in liquids, has been announced by the General Electric Company's special products section, Schenectady 5, N. Y.

Developed for use in any process where turbidity is a significant factor, the G-E device can be used with an audible or visible alarm. It provides readily available turbidity measurements for monitoring and controlling. Adjustable over a wide turbidity range, the turbidimeter has a splash-proof construction and semi-null-balance system.

Specific applications include plants with private water supplies where turbidity has a direct effect on processes; monitoring of wastes dumped into streams and lakes to guard against pollution; water treatment plants where turbidity of incoming water determines the amount of flocculation chemicals to be added; detection of oil contamination in boiler feed water; soil erosion studies; and in any process where filter effectiveness must be constantly monitored. For more information on this instrument, use Reader Service Card.

E—1122. Improved Cut-off Wheel—Norton Company, Worcester 6, Mass., announces an improved reinforced, resinoid, hub-type cut-off wheel. Known as the BFR wheel, this wheel replaces one with the same designation which has been on the market.

Longer life is the main feature of the improved wheel. Tests show that increased life of up to a third more than the former wheel can be expected with the same quality of cut. These more durable wheels also tend toward a better uniformity in grinding action wheel to wheel and lot to lot. The improved BFR wheel shows practically no tendency to fray or split at the face in layers. For additional information on this product, use Reader Service Card.

E—1123. Dual-Film Anodizing Process—A new concept in the anodizing of aluminum, the new process marketed by Philton, 200P W. Ninth St., Wilmington, Del., is the latest development in the electrolytic protection of aluminum and aluminum alloy surfaces. It is distinguished by low cost, and by the quality of the surface generated. It is known as the EC process.

The process produces a protective film with superior corrosion resistance, with the added advantages of unlimited decorative possibilities in color and texture, from crystal clear through all colors to jet black.

The EC process costs less for comparable protection than either the conventional sulfuric or chromic acid process. For more information use Reader Service Card.

E—1124. New Automatic Plating Machine—Wagner Brothers, Inc., Detroit, Mich., announce a new fully automatic electroplating machine that introduces a revolutionary approach to the design of plating transfer machines, and holds much interest not only for those interested in plating but also for anyone interested in automation.

The new machine, now thoroughly tested in production, has no elevating super structure, no transfer cams, no chains or sprockets and no hydraulic fittings above the tanks. The transfer and conveying principle, around which the machine is built, has but two reciprocating movements, longitudinally and vertically, eliminating many complicated motions which have been accepted as necessary in all previously produced automatic plating machines.

All working parts are mounted on a central carriage which moves on a single track and is actuated by an hydraulic cylinder. Basically, this supplies the horizontal motion to the work through the cleaning and plating tanks and drying oven which surround the carriage.

A shaft running the length of the carriage, near its top, is fitted with gears which are meshed to racks on work lifting arms. This assembly provides the vertical motion which lifts and lowers the work out of and into the tanks. For more information on this new equipment, use Reader Service Card.

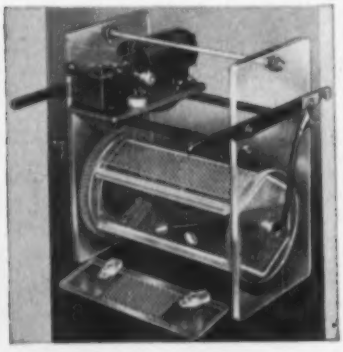
E—1125. Corrosion Resistant Duct—Metalwash Machinery Corp., 901P North Avenue, Elizabeth 4, N. J., now designs and fabricates corrosion-resistant vent systems and duct work of Uscolite, a U. S. Rubber Company product.

Uscolite is a thermoplastic synthetic rubber-resin composition possessing an outstanding combination of structural rigidity, high impact strength, dimensional stability, and chemical resistance.

The material has been used extensively

for some time in the manufacture of pickling, drying, and phosphating machines where hoods, ducts, stacks, and air-washing systems form an integral part. For more information, use Reader Service Card.

E—1126. Lucite Portable Plating Barrel—A new portable plating barrel streamlined for easy use and low cost production is announced by Belke Manufacturing Company, 947P N. Cicero Ave., Chicago 51, Ill.



Weighing only 28 pounds, the model SPX Porto-Plater is easily set in the plating tank by hand. A "V" shaped cathode contact notch fits cathode rod at any point.

The obstruction-free cylinder is of high temperature Lucite. Other details feature a Lucite cover with attached cover locks, Lucite hangers, gears, bushings, and a ball contact with a one-piece dangler cable. For more information on this new equipment use Reader Service Card.

E—1127. Siliconized Witch Oil—The Mitchell-Bradford Chemical Co., 2446P Main St., Stratford, Conn., announces the development of a new product Siliconized Witch Oil.

It is a rust preventative that gives extra protection and better lubricating qualities to parts.

When applied over a black oxide, phosphate or other type of finish, it assures a greater corrosion resistance at a much lower cost per hour of protection. Siliconized Witch Oil is ideal for protecting work in process or finished parts in storage. For more information on this product use Reader Service Card.

E—1128. Improved Acid Hose—Development of a hose highly resistant to a wider range of acids, salts, alkalies and other solutions has been announced by Raybestos-Manhattan, Inc., Manhattan Rubber Division, Passaic, N. J.

According to the manufacturer, this improvement has been made in its Condor acid discharge and Condor acid suction hose by compounding a new special synthetic with other acid-resisting materials for tube and cover. The improved hose withstands many organic and inorganic acids, salts and alkalies, and plating solutions much longer than conventional acid hose, and can be used to convey other solutions previously not recommended for rubber hose. The tube of this hose also is claimed to be highly abrasive resistant to withstand slurries. For more information on this product, use Reader Service Card.

E—1129. Bright Copper Process—A new bright copper process that increases plating production up to 60 per cent has been developed by Smoothex, Inc., 10705P Briggs Rd., Cleveland, Ohio.

Many desirable characteristics are contained in this new process. It is faster, easier to control, extremely economical and readily adaptable for both large scale and average job shop production. There is no need for purchasing new plating department equipment since present equipment may be used.

The process is 98 per cent efficient. It saves nickel and eliminates the operation of copper buffing. It has exceptional speed of deposition and excellent throwing power. Ductile deposits and low copper concentrations are featured in the process. For more data use Reader Service Card.

E—1130. Unplasticized PVC Valves—Needle and globe valves are now available in quantity for use with Boltaron pipe and fittings in solving plant corrosion problems, H. N. Hartwell and Son, Inc., Boston, has announced. The new valves are available in standard ips of ⅛, ¼, ⅜, ½, ¾, 1, 1¼, 1½, and 2 inches.

Now that valves have been perfected, complete piping systems can be installed to handle corrosive liquids without using valves made of less corrosion-resistant materials that have to be replaced frequently. For more data on these valves, use Reader Service Card.

E—1131. Rigid PVC Plates and Sheeting—Kaykor Industries, Inc., Yardville, N. J. announces the availability of Vyflex rigid polyvinyl chloride plates, sheeting and other special forms. Made from completely unplasticized and unmodified polyvinyl chloride, it is free from fillers and processing aids, thus assuring outstanding corrosion resistance and high strength.

In addition to all standard methods of fabrication for thermoplastic materials, Vyflex PVC can be fabricated by hot-gas welding, which makes possible the construction of complex units and structures such as fume exhaust systems, acid tanks and other equipment or parts exposed to severe corrosive conditions. For further information, use Reader Service Card.

E—1132. Carbide Belt Finisher—A new carbide tool finishing machine, using abrasive belts, has been announced by Hammond Machinery Builders, 1604 Douglas Ave., Kalamazoo, Mich. With this new method and new machine which have been proved in actual production, it is possible to final-finish single point carbide tools without diamond wheels, and without highly skilled operators.

The Hammond Model 454 carbide belt finisher is for final finishing with an abrasive belt after rough grinding with a silicon carbide wheel. It features—tungsten carbide faced platen—conventional work table—low cost initial investment.

This finishing machine also can be used for sharpening tools made from high-speed steel and for miscellaneous grinding and sharpening operations. For more data on this machine, use Reader Service Card.

E—1133. Vacuum Metallizer—Compactness in the layout of the vacuum pumping equipment and a high degree of automation in the control system with interlocks to guarantee safety and dependable operation are the noteworthy design features of the new 72-inch vacuum metallizing unit which has been developed by the F. J. Stokes Machine Company, 5502 Tabor Rd., Philadelphia 20, Pa.

Rapid pumpdown of the chamber, which is 72 inches in diameter and 60 inches long, is accomplished by a three-stage pumping system, comprising a 500 cfm. rotary mechanical pump for roughing, a booster pump, and three oil diffusion pumps. For more information on this product, use Reader Service Card.

BETTER BUFFING — *EVERY WAY* — WITH BEACON

For every buffing need, there is no better choice in wheels than *Beaco*. In performance, engineering, wear, materials, workmanship and every other quality that makes the difference for peak production, *Beaco* buffing wheels have proven themselves superior.

There is a *Beaco* buffing wheel for better performance in every type of buffing operation. Write today for full information on the *Beaco* buff that meets your requirements.

. . . and the right compound to do the job right

Improved and quicker cutting and coloring that mean substantially greater production at less cost offer the perfect complement to *Beaco* buffing wheels in the new line of Beacon compounds.

The *Vincite* iron-free, natural abrasive compounds for brass, copper, aluminum, die castings and plastics; the *Violet Ray* compounds, made without animal, fish or mineral greases; and the *Beacon* compounds manufactured with conventional greases in an excellent line of tripoli, stainless steel and lime finish — all offer a dependability and superiority for their specific purposes that are beyond any in the field.

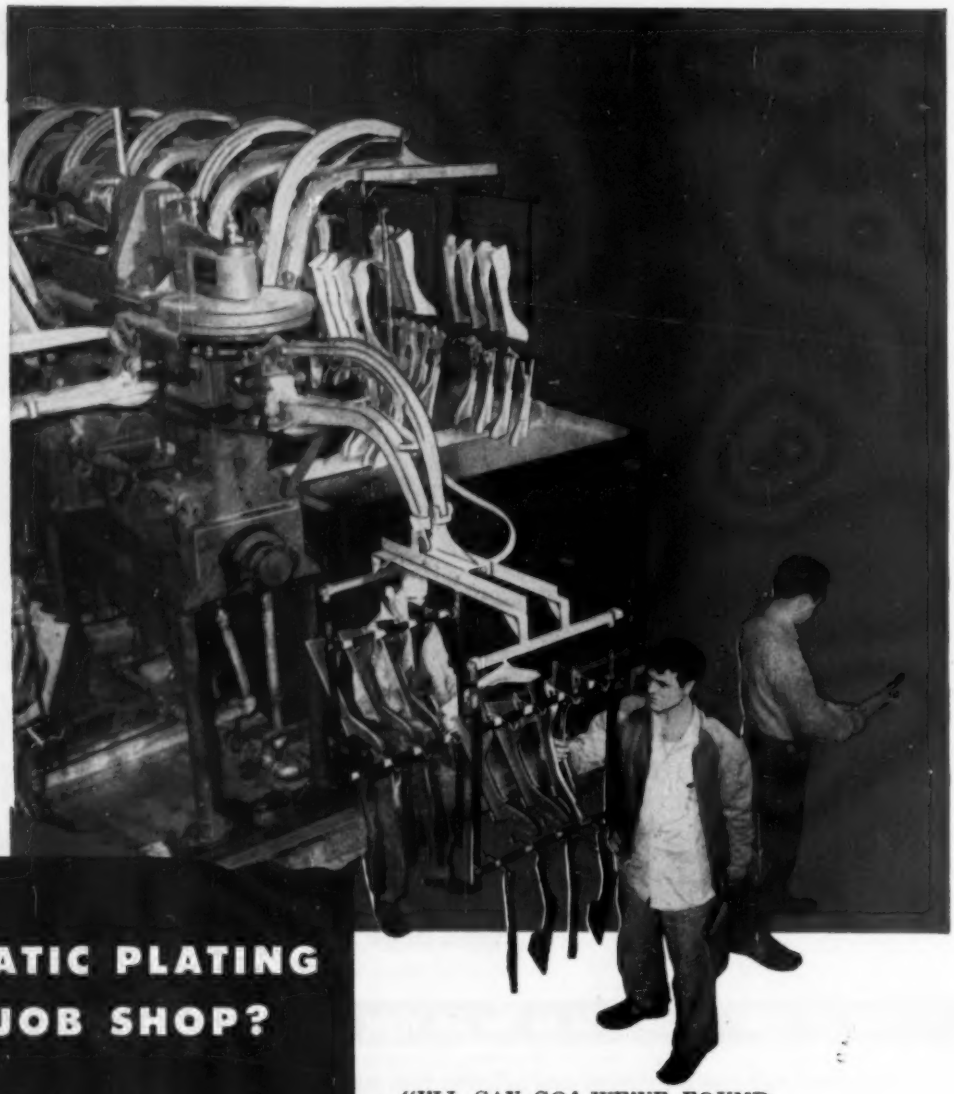
A trial will convince you — write today.

Beacon plants in the East and Middle West

ESTABLISHED 1888

BEACON SUPPLY CO.

110 Marginal St., Chelsea 50, Mass.



AUTOMATIC PLATING IN A JOB SHOP?

"I'LL SAY SO! WE'VE FOUND STEVENS EQUIPMENT ENABLES US TO TAKE ON ALMOST ANY JOB."

That's what Mr. Louis S. Morse, Jr., president of Detroit Plating Industries, says about Stevens machines used in his modern plating shop.

Detroit Plating Industries has four Stevens machines in operation. Three are full automatic rack type, and one is a Stevens Automatic Barrel machine. With this equipment, Detroit Plating Industries get precise control of plate thickness – they handle a diversified group of products – and they can quickly shift from one order to the next.

Let Stevens show you how to up production . . . cut costs . . . in your job shop. Write FREDERIC B. STEVENS, INC., Detroit 16, Michigan.

FREDERIC B.
STEVENS
INCORPORATED
EVERYTHING FOR METAL FINISHING

BRANCHES: BUFFALO • CLEVELAND • INDIANAPOLIS • NEW HAVEN
IN CANADA: FREDERIC B. STEVENS OF CANADA, LTD., TORONTO • WINDSOR

plating

Dedicated to the improvement and dissemination of the knowledge of the arts and sciences of electroplating and of finishing of metals and of allied arts.

NOVEMBER, 1953 VOL. 40, No. 11

Contents

Question and Answer Session 1230

An Electronic Thickness Gage 1238
Abner Brenner and Jean Garcia-Rivera

Thickness of Electrodeposited Coatings by the Anodic Solution Method 1245
C. F. Waite

Testing Organic Finishes and Interpretation of Results 1255
C. O. Hutchinson

A. E. S. RESEARCH REPORT:
Project No. 12: Cleaning and Preparation of Metals for Electroplating. VII. Final Summary on Degreasing Evaluation Tests 1269
H. B. Linford and E. B. Saubestre

New York Branch Host—41st Annual A. E. S. Convention 1273

Monthly Features

Advertising Index 1311
A. E. S. Directory 1308
A. E. S. News 1288
Article Abstracts 1276
Book Review 1274
Branch News 1290
Editorial 1229
Equipment and Supplies 1223
Future Meetings 1312
Industry News 1194
In This Issue 1192
Intersociety News 1204
Membership Report 1306
Patent Abstracts 1281
Personals 1206
Trade Literature 1216

Staff

Managing Editor
P. PETER KOVATIS

Editor
A. KORBELAK

Editorial Board
J. M. Andrus, E. R. Bowerman, L. Diveley, F. Fulforth, W. Geissman, D. Gray, W. R. Meyer, L. M. Morse, M. Nadel, C. W. Ostrander,

Advertising Manager
W. C. DIETRICH

LEE F. O'CONNELL, Western Representative (111 N. La Cienega Blvd., Beverly Hills 48, Calif.; 544 Russ Bldg., San Francisco 4, Calif.)

Production Manager
M. K. DICKINSON

This month's cover, a view of New York's harbor, depicts one of the sights in store for those attending the 40th Annual AES Convention.

Published by the American Electroplaters' Society. Publication Office: 5800 N. Marvine Street, Philadelphia 41, Pa. Phone: LIvingston 8-7800. Editorial, Advertising and Executive Offices: American Building, 445 Broad Street, Newark 2, N. J. Phone: Humboldt 2-3400. Subscriptions: Domestic and Canada, $4.00 for 1 year; $7.00 for 2 years; 50c per copy; Foreign, $8.00 per year; $1.00 per copy.

Copyright, 1953, by the American Electroplaters' Society.

PLATING is abstracted regularly in Chemical Abstracts, Metallurgical Abstracts, Engineering Index, Technical Data Digest and Bulletin Analytique.

Articles appearing in this publication may not be reproduced in full or in part without expressed permission from the Managing Editor of PLATING.

HARSHAW ANODES and CHEMICALS

You can depend on Harshaw products to keep your production moving. For more than fifty years we have concentrated on improving the quality of the anodes and chemicals used by platers.

NICKEL PLATING

. . . still and barrel . . . nickel anodes—all commercial grades and sizes . . . anode bags . . . single nickel salts—nickel chloride . . . nickel carbonate . . . nickel fluoborate . . . boric acid.

CHROMIUM PLATING

. . . pure "Krome Flake" 99.8% CrO_3 . . . sulphates less than .10% . . . lead, tin-lead and antimony-lead anodes.

COPPER PLATING

. . . copper ball anodes . . . Rochelle Salts . . . sodium and copper cyanides . . . copper sulfate . . . copper fluoborate.

CADMIUM PLATING

. . . ball and cast cadmium anodes . . . cadmium oxide . . . sodium cyanide . . . cadmium fluoborate.

TIN PLATING

. . . cast tin anodes . . . sodium stannate . . . stannous sulfate . . . tin fluoborate . . . acid tin addition agent.

ZINC PLATING

. . . ball and cast zinc anodes . . . sodium and zinc cyanide . . . zinc sulfate . . . zinc fluoborate.

LEAD PLATING

. . . cast lead anodes . . . lead fluoborate.

SILVER PLATING

. . . silver cyanide.

The HARSHAW CHEMICAL Co., Cleveland 6, Ohio

Chicago 10, Ill. • Cincinnati 13, Ohio • Detroit 28, Mich. • Houston 11, Texas
Los Angeles 22, Calif. • Philadelphia 48, Pa. • Pittsburgh 22, Pa. • New York 17, N.Y.

Editorial

THE BUSINESS and Defense Services Administration, U. S. Department of Commerce, revoked effective, November 1, 1953, its order M-80 and its schedules under which nickel has been regulated by the government for more than two years. End-use restrictions die with Schedule 1 of the order, much to the relief of the hard-hit electroplating industry.

However, the action is only a "hunting license" in that it allows platers to use the metal on any products; it does not provide for additional allotments of nickel to the industry. The supply of nickel for the civilian economy will be that remaining after the requirements of the military and the Atomic Energy Commission are fully met. Thus, the order's revocation results in a "robbing-Peter-to-pay-Paul" situation. More articles can be plated with nickel, but no more nickel is allocated.

Admittedly, it was unfair to the plating industry of this country to continue controls while foreign competitors were free to merchandise articles that domestic companies were forbidden to manufacture. On this account alone, the relief produced by the order's revocation was long overdue.

The arithmetic necessary to arrive at the answer to the supply situation of the metal in the foreseeable future is now being worked out. That there will be some adjustments in favor of the plating industry is hoped for. Bright spots may be noted in the picture from the words of (1) the Director of Defense Mobilization . . . "it is not illogical to expect that supplies of nickel made available to the United States will increase upon removal of end-use restrictions"; and (2) a spokesman for a major producer who stated that his company would continue to ship to suppliers and distributors on a fair and equitable basis.

Al Korbelak

QUESTION AND ANSWER SESSION*

Moderator: Dr. Abner Brenner, Baltimore-Washington Branch

Panel: Authors of Educational Session papers

Chairman Brenner: We are about to begin this Educational Session. I am really gratified to see the wonderful turnout, after your rather hard day of listening to papers.

I would like to introduce the experts this evening; . . . The following people were present on the platform and arose when Dr. Brenner called their names: C. Frederick Paulson, Permutit Company, New York, N. Y.; C. F. Waite, King-Seeley Corporation, Ann Arbor, Mich.; Edwin W. Hoover, Henry Brown, The Udylite Corporation, Detroit, Mich.; Ezra A. Blount, Products Finishing, Cincinnati, Ohio; Edward F. Foley, Enthone, Inc., New Haven, Conn.; P. B. Lonsbury, Walton & Lonsbury, Attleboro, Mass.; A. Korbelak, Plating, Newark, N. J.; Martin Quaely, Westinghouse Electric Corp., Bloomfield, N. J.; R. Dow, United Chromium, Inc., Detroit, Mich.; Ralph F. Muraca, Lehigh University, Bethlehem, Pa.; Edwin C. Rinker, Sel-Rex Precious Metals, Inc., Belleville, N. J.

Chairman Brenner: With a program of this kind, it is necessary to have some rules to give this affair the right atmosphere. There are two rules—one for the corps of experts and one for the audience. The rule for the experts is that in answering questions, they are not permitted to take more time than they did in presenting their papers. The rule for the audience is that they may not ask an expert (if he is one of their business competitors) the composition of any proprietary mixture. This is not because I don't want you to embarrass them, but you would be wasting your breath.

A gentleman from Westinghouse had some questions about plating on stainless steel.

Mr. R. C. Westphal (Westinghouse Electric Corp., Atomic Power Division, Pittsburgh, Pa.): I am speaking as a customer of chromium plating rather than a plater. We have a critical application for the use of chromium plate as a wearing surface under various wearing conditions on unlubricated surfaces. We require material that has both corrosion resistance and wear resistance. Our problem is: how can we assure ourselves that the chromium plate from various suppliers will have adequate adherence to the base material which in every case is a stainless steel?

Up to the present time we have developed a qualifying test of our own. It is, more or less, a surface wear test under the proposed operating conditions which a prospective supplier must pass in order to plate production work. About ten per cent of the prospective platers generally pass.

Chairman Brenner: I am going to give this distinguished panel a chance to volunteer an answer to the question. If no one volunteers, I will ask someone to answer it. (After conferring with the members of the panel): We are not quite sure whether you want a test for adhesion or whether you just want to know where you can get a good job of plating done.

Mr. Westphal: Perhaps that is one phase of it—to be able to tell when you have good adhesion. Another problem is—how to specify the conditions and procedure of the plating to the supplier, as is usually done by our concern, which will better guarantee an effective adherent coat.

Mr. Korbelak: As a check on the adherence of the chromium, if the parts are not too large, you might try a thermal cycling test. Such a test would involve heating of the parts to a predetermined temperature with your limit set at a point consistent with the service requirements of the plated coating. Rapid cooling in a solution of dry ice and alcohol or liquid nitrogen would follow the heating operation. Safety measures in such testing should not be overlooked.

Mr. Lonsbury: I would have no suggestions other than the Air Force's specification test which is pretty much destructive and depends upon grinding and extreme bending.

For normal chromium on stainless steel, providing it is clean and not covered with scale, we find two methods suitable—either reverse current etching in sulfuric acid or the one that seems to be preferred by most is reverse current etch in chromic acid solution and then a gradual building up of the plating voltage, almost like chromium over chromium procedure. We

*Presented at the Fortieth Annual Convention of the American Electroplaters' Society, Tuesday evening, June 16, 1953

get excellent adhesion if we use either procedure. We have done quite a bit of it, too.

CHAIRMAN BRENNER: How do you feel about these answers, Mr. Westphal?

MR. WESTPHAL: The thermal cycling test is one that would lend itself to testing of finished pieces very well; the method of plating as outlined is generally used by both successful and unsuccessful platers, I believe. From my meager knowledge of the situation, there appear to be a great many small detailed steps which must be carried out to assure a good plate and while I mention one or two, that, as far as I know, is not sufficient.

CHAIRMAN BRENNER: I think Mr. Westphal means to intimate that there are so many details that failure to observe any one of them might lead to failure.

MR. MORTON SCHWARTZ (Surface Alloys Engineering Co., Los Angeles, Calif.): A rather long, involved discussion on the many aspects of this question could be developed since it involves a complicated situation. Aside from the question of the initial adhesion of the deposit, my experiences indicate that when chromium deposits are used for dry wearing applications, that is, where no lubrication is involved, the whole problem of galling enters the picture.

Thus the heat generated in the system, especially under high bearing loads, may cause the development or enlargement and coalescence of cracks which may result in the lifting of small islands of plate (which, incidentally, may have base metal still adhering to them), causing galling and severe scoring of either or both of the wearing combination.

My suggestion is that you should follow the old adage "the proof of the pudding is in the eating" in a situation like this. The best inspection or test methods, I believe, are actual performance tests of the parts under the conditions normally employed in use. These tests may or may not be done on a statistical basis, but should be done periodically on parts selected from lots supplied by the plater. Adhesion tests on parts or samples are not sufficient to determine whether or not the parts will function properly. You could be sadly disappointed by operational failures when reliance is put in a single method or test outside of the actual environmental conditions involved.

CHAIRMAN BRENNER: Any other comment on this particular subject? I think Mr. Westphal is learning of some new difficulties and I think maybe he is sorry he brought the question up.

Would someone like to comment on a different subject? Earlier in the program yesterday there was a lot of comment on gold plating. Has the polish been worn off of that subject?

MR. WILLIAM E. TREMBLEY (Texas Instruments, Dallas, Texas): We have a particular problem of brass and copper pieces which are assembled into wave guides for electronic equipment. These particular pieces are silver soldered together. We are experiencing rejections on these pieces sometimes as high as 20 to 50 per cent.

The complexity of these parts is such that it is impossible to fabricate conforming anodes to install within the mechanism itself. Therefore, the coating must be applied to the inside of the compartments by immersion only.

Yesterday, in the discussion on gold plating, nothing was mentioned about cleaning, but we are searching for a method which may in some way alleviate our cleaning troubles and hence reduce our rejections. The main problem we encounter is the burning of the copper and copper alloys. The mixing of these combustion products with the flux used forms a complex mass which is extremely hard to remove.

Do you have anything to suggest? At present we are running the particular pieces through the cleaning cycle five to eight times and still obtaining rejections of a high percentage. We have tried these cleaning cycles as high as 15 times with the same trouble being encountered.

MR. RINKER: It is true that if you use a conventional bath you will get plating by immersion. It is also true that there are many parts of complicated shapes that require auxiliary anodes and I have seen some very remarkable auxiliary anodes. They have taken stainless steel coils and placed them in tubes made of spun glass and inserted them into the intricately shaped tubing and they do a remarkably good job.

As far as cleaning the surfaces, I am a little dubious about the use of bichromate-sulfuric acid pickle as a preliminary bright dip inasmuch as you have a silver soldered assembly. If you can get away with that bright dip and then follow that by a concentrated hydrochloric acid dip, you will have a reasonably clean surface upon which to plate and using flexible anodes you can do a good job of gold plating on the significant surfaces.

MR. TREMBLEY: The cleaning cycle which we are using at present on these pieces is (1) steel cleaner which is non-smutting on the brass and copper; (2) hydrochloric pickle, about 50 per cent; (3) cold rinse; (4) nitric-chromic pickle (½–1 per cent nitric).

We have found a sulfuric-chromic pickle to be extremely undesirable because, although it does a wonderful job on copper and brass, silver chromate films are formed. By the use of a nitric-chromic pickle, we can brighten the silver solder as well as the copper and copper alloys.

Due to the fact that the inside of the piece is completely shielded it is difficult to clean and plate.

We have found that through the use of this chromic-nitric pickle for several cycles the finish is badly etched.

Do you have any suggestion, for a cleaning process?

MR. QUAELY: I would make one suggestion about combining several solutions. First, use a bright dip of sulfuric-nitric-water for a few seconds; rinse; then use a dilute solution of cyanide followed by thorough rinsing in water.

MR. TREMBLEY: The difficulty with that is when

you run through the cycle several times, etching is quite severe.

MR. QUAELY: Why use it six, seven times?

MR. TREMBLEY: You have not seen this piece.

MR. MODJESKA: At the Armour Research Foundation, they have made conforming anodes by use of stainless steel and glass tubing. Now, if you use high frequency superimposition on an electrolytic sulfuric pickle going up to somewhere between 50 and 70 megacycles on the superimposed current with the a.c. slightly less than your d.c., you will clean your parts in one application.

MR. TREMBLEY: How much does it cost?

MR. MODJESKA: The set-up for that type of operation is surprisingly low. Auxiliary alternating current equipment will cost possibly only a couple of hundred dollars. It is done with a very simple condenser frequency oscillator set-up.

MR. EDWIN R. BOWERMAN (Sylvania Electric Products, Inc., Flushing, N. Y.): I want to offer first a comment on wave guide plating. The general requirement is that you use a minimum of chemical procedures in cleaning them. The place to build-in the cleaning is from the very beginning of the assembly. If you protect the surfaces from any tarnishing during every single operation, you can go directly into your plating cycle with a minimum of problems. This does call for the cooperation of the manufacturing group, but it represents a standard practice in construction of wave guide equipment. It is very difficult to build wave guide equipment with good operating characteristics if the dimensions on the internal surfaces depart more than a few tenths of a mil from the specifications. Repeated pickling or bright dipping will cause trouble especially at the important joints.

I have a question . . . Several years ago Dr. Stareck made a very interesting proposal that an undercoating of silver be used under nickel in order to obtain good corrosion resistance. We tried the idea in our laboratory and obtained very satisfactory salt corrosion resistance.

Has anybody pursued this matter further and actually put it into commercial application?

DR. STARECK: A couple of years ago we did do some experimental work on combination coatings and I gave a paper on it at that time in which silver was used as a more noble metal. The theory proposed at the time was that if we could get two metals, having either a very small potential between them, or preferably the one underneath being more noble than the surface one; then we could stop corrosion of the base metal. Chromium, however, in its passive condition is very noble and it is impossible to get anything more noble. It can only be approached and silver was one of the metals that was considered for that purpose at the time. While I still think it has possibilities, as far as I know, no one has used it commercially.

MR. WILLIAM P. INNES (MacDermid, Inc., Waterbury, Conn.): Dr. Brown, would you care to comment on the atmospheric corrosion resistance of copper plus nickel and brass plus nickel, versus all nickel on steel?

DR. BROWN: The relative corrosion protection value of these coatings with a final chromium plate still seems to be a controversial subject. The question is in general: can one substitute say one-half of the nickel thickness by an equal thickness of copper underneath the nickel. There is an excellent paper on this subject by Knapp and Wesley in PLATING (January, 1951). They report on results with panels in an industrial atmosphere. They did not, however, report on results with panels in a marine atmosphere. W. M. Phillips of General Motors Corporation follows the paper by Knapp and Wesley, with a review which is based on inspections of the chromium plated parts of automobiles in parking lots. His results are not in agreement with those of Knapp and Wesley. The chromium plate on cars is washed at least once in a while and also a certain percentage of automobiles are kept in garages over-night during late fall, winter and early spring when corrosion is proceeding at its fastest rate in an industrial atmosphere. This is taken to be the reason that the results of Knapp and Wesley, which indicate that inferior results are obtained by replacing substantial thicknesses of the nickel deposit with a copper undercoat, differ from the results obtained by this inspection of plate on automobiles.

Our results in an industrial atmosphere are similar to those of Knapp and Wesley.

CHAIRMAN BRENNER: These were all on steel?

DR. BROWN: Yes. Of course, thin nickel plate of about 0.3 to 0.5 mil with a final chromium coating on solid yellow brass panels gives quite different results than those obtained with these same thicknesses of nickel on top of copper plated or brass plated steel where the latter coatings on the steel are approximately 1 mil thick. Once the corrosion pit is through the nickel the corrosion of brass or copper proceeds preferentially, and at a faster rate than the nickel in an industrial atmosphere. When the copper or brass plate is perforated then the attack on the steel proceeds at an even faster rate and with greater undermining at the interface of copper and steel than when an equal thickness of nickel is present against the steel. However, with very thick brass or copper or a solid brass or copper panel the corrosion pit also widens and deepens in the brass or copper at the interface with the nickel plate, but at a much slower rate compared to the rate of attack of steel at the interface of copper-iron or brass-iron in an industrial atmosphere.

MR. INNES: How does it stand up in salt-spray?

DR. BROWN: In the salt-spray, unlike an industrial atmosphere, there is little difference in results from substituting say one-half of the nickel thickness by a copper or brass undercoating on steel. One interesting point about salt-spray results with chromium plated nickel coatings on steel is that a cyanide copper strike or a low *p*H nickel strike tends to give consistently better salt-spray results than when no strike is used. If a very short copper strike is used, for example under one-half minute, and if an acid dip is

subsequently used and the transfer time after rinsing is not rapid, rusting will occur in the pores of the thin copper plate before the work is transferred to the nickel bath, which will then result in poor salt-spray results. Therefore, thorough or pressure rinsing without using an acid dip after the copper strike is better practice if the copper strike is very thin and the transfer times are appreciable.

MR. AUSTIN FLETCHER (Enthone, Inc., New Haven, Conn.): Aluminum landing gear, 5 inches in diameter, have to be chromium plated to a thickness of 0.005 inch.

The procedure after cleaning is a zincate dip followed by a chromium bath with the current on and the temperature at 70° F. The chromium bath temperature is raised in one hour from 70° to 120° F and plating continues for an additional nine hours.

After plating the deposit is ground to specification. Somewhere along the line due to this temperature change, they think, or due to the grinding method, the chromium seems to separate.

Does anybody think it might be this raise in temperature or grinding operation that is causing the trouble?

MR. LONSBURY: I would very much mistrust any qualities of the starting deposit. At low temperatures chromium is not very strong—it is fragile. Elevating the temperature while plating is not harmful.

MR. SCHWARTZ (Los Angeles): Do they put the part in the chromium solution when the solution is at 70° F and commence plating; then as they continue plating, they increase the temperature of that particular bath—is that the procedure?

MR. FLETCHER: That is right.

MR. SCHWARTZ: There is a publication, I don't know whether it is French or German, in which that type of solution is proposed as a chromium strike. The part is immersed into a chromium bath at room temperature, given a strike, and transferred to a standard chromium plating solution. The practice you described seemed to me to be impractical for production since "down-time" for cooling is involved after each load is plated. If they want to use that particular procedure, they should try using a strike solution at that temperature and then transfer to a conventional chromium bath.

CHAIRMAN BRENNER: Is this primarily a problem of adhesion?

MR. ROBERT B. GOODSELL (Enthone, Inc., New Haven, Conn.): This particular case happened to be on 72 S aluminum. The manufacturer uses a conventional 33 ounce per gallon chromium plating bath. I had loaned them a copy of *Proceedings* in which Dr. Brenner's paper appeared on "Physical Properties of Deposited Chromium", and I must admit that they got a lot out of it, and were really interested in going into its fine points. Here is what they brought out—they got the impression that at 70° F you would get a matte, hard, more or less brittle type deposit. Am I correct there?

CHAIRMAN BRENNER: Yes.

MR. GOODSELL: The problem seems to be this, then: they have spent a lot of money to equip tanks with cooling coils and it takes time to cool them down to 70° F. They start off plating at 2 amps/sq in and maintain that current density throughout the entire time of ten hours.

What they are running into occasionally in the grinding operation are cracks. It seems like a laminated type deposit where chromium is peeling on chromium. When they grind these parts down to around 0.005, which is the finish, are they getting into this hard, brittle deposit and is that causing the cracking of the deposit? In other words, the efficiency of the bath is far greater at the lower temperatures than it is at the higher temperatures, so in the first hour, we will say, of deposit, they are getting a brittle deposit and when they grind down to this point, that is causing this flaking.

CHAIRMAN BRENNER: I don't think that could be quite the answer. All chromium is brittle—there must be other factors involved. I am not sure that those conditions you mention were ever set forth to be good plating conditions. Would someone who has had more recent data like to answer?

MR. LONSBURY: I think that there is very possibly a mushy, fragile deposit to start with.

DR. HAROLD J. WIESNER (Bendix Aviation Corporation, South Bend, Ind.): We have been performing this same operation in our plant for the last two or three years.

CHAIRMAN BRENNER: You mean this low temperature plating?

DR. WIESNER: Yes. As a matter of fact, these people are subcontractors of ours. We have not experienced this same trouble.

CHAIRMAN BRENNER: Do you think the data in our paper on chromium plating is at fault?

DR. WIESNER: I would rather suspect that if they are getting a double plating effect that there might be something like an operator removing the part, checking it and not using sufficient care in returning the piece to the bath. At least some type of current interruption is indicated. The indications are, in all the work that we have done, that the temperature, particularly in the small baths which they use, would rise within the first hour to the correct operating conditions. In which case the plating thickness would be less than what they would be grinding off. Therefore I am sure that if they are having this flaking appearance or double plating or whatever the problem is, that it is not due to the cycle which has been described. I repeat again, we have used the method for the past two or three years and have not experienced that type of trouble.

CHAIRMAN BRENNER: I am glad to know that. Could you give us any reason why these conditions are used? I think we are all a little curious as to why you used them.

DR. WIESNER: The basic reason is to obtain maxi-

mum adhesion. If a conventional zincate dip is used, followed by plating in a warm chromium bath, the tendency is for rapid dissolution of the zincate film with a high probability of poor adhesion. This is particularly true on large pieces such as those in question, since the time required to get the pieces in the bath is great. However, if you use a cold chromium solution and start the piece in this chromium solution with the current on, you can get a sufficiently good adhesion to meet all the requirements. Our experience in general has been that this procedure is much more to be desired than that using a zincate, for example, copper strike followed by a chromium.

The adhesion results that we get by using this technique will meet all the requirements.

MR. LONSBURY: Have you tried starting the plating at the standard conditions, 120 or 133° F?

DR. WIESNER: Some work was done starting the bath at 120–130°. Adhesion results were very poor because of the fact that the zincate film dissolves very rapidly under those conditions.

MR. LONSBURY: I have not plated too much chromium directly on aluminum and certainly not .010 inch thickness of chromium. Still, I have applied 0.002 inch directly to the zincate coat with apparently good adhesion and apparently the zincate surface was not removed. We did have voltage applied before putting the pieces in the chromium bath.

DR. WIESNER: What type of adhesion test do you employ—what do you consider good adhesion?

MR. LONSBURY: Well, this unfortunately was cast material where we didn't have the privilege of using any destructive test, and it did not have to be ground. But, there were times when we had a lack of proper guards and there was a considerable build-up of corners—probably built to 0.006 inch or 0.008 inch and we ground those off on the standard polishing wheel, which does give quite a beating to the piece. Beyond that we didn't have any adhesion tests.

DR. WIESNER: These pieces must be subjected to a bend test, crushing test, actually to the point where it fractures the part and still doesn't flake. We have other parts which are small—an aluminum cylinder—in which case we simply sandblast the pieces, put them in the chromium tank. Simply sandblasting the pieces then putting them right in the tank will give fair adhesion, but on aircraft parts adhesion requirements are much more rigid.

MR. FRANK PASSAL (United Chromium, Inc., Detroit, Mich.): There is a procedure where chromium can be deposited from a bath at elevated temperature, using a cleaning procedure which involves a special zincate film. During this procedure, zincate film is dissolved so that in effect you get direct deposition of chromium on aluminum. The adhesion tests we have made have involved deposits of anywhere from 10 to 20 mils of chromium directly on aluminum. Such deposits have been subjected to alternate heating and cooling cycles and also honing.

The exact procedure in the process is subject to patent application and will be issued very shortly. If anyone is interested in the details of this procedure, especially if it involved defense work, we will be glad to give them the information on it.

DR. L. E. LANCY (Ellwood City, Pa.): I would like to make a comment to a previous question regarding the separation of chromium deposits. When starting the deposition at 70° F the full 2 amp/sq in current density could not be applied because it would be too high at such a temperature. Most likely the temperature and current is stepped up gradually. It could very possibly be that at some point the rate of current is too low for deposition to be maintained for the temperature at that particular time. Thus one can easily imagine a situation where deposition is started again, the new deposit not adhering to the previous chrome layer.

MR. LAWRENCE J. DURNEY (Enthone, Inc., New Haven, Conn.): In a previous connection, we had a similar experience with deposits of this type. Deposits, however, were on steel and at normal current densities. We did nevertheless encounter the same condition described, in which a separation of the plate, apparently due to lamination, occurred in the grinding process. The thicknesses involved were much the same, 0.015 inch to 0.018 inch of chromium on the diameter, later being ground to a coating of 0.010 inch. Microscopic examination gave no indication of any lamination in the plate. Failures were traced to high contact temperatures and shear stresses set up in the grinding operations. By using a diamond wheel dressed with rather more than the usual frequency and replacing the soluble oil type lubricant with a solution of ¼ oz/gal of sodium bicarbonate, we were able to reduce the contact temperature of the grinding operation. This, in turn, eliminated the problem of plate separation.

MR. GOODSELL: Where can we obtain information on the proper technique in grinding hard chromium?

MR. INNES: There are three factors involved here: (1) 2 amp/sq in at 70° F, particularly at sharp edges, would give you a burn and increasing the current density as the temperature goes up or plating at the same current density would cause laminations. I think that point is a possibility.

(2) We have noticed, particularly in zincate films, that when the lack of adherence is suspected, local heating is the best method of blistering the electrodeposit. If they are getting local heating due to grinding, they might expect failure of adhesion. However, (3) a good zincate film on properly cleaned metal should withstand a fairly high temperature—about 850° F. I would recommend for this job that a nickel strike be employed prior to a conventional chromium plate.

MR. JULIUS TERES (U. S. Air Force, Wright Patterson Air Force Base, Ohio): I have a question for the experts.

During the War, on certain electronic applications, "whiskering" on cadmium was experienced. Has any-

one done any work on tin-cadmium or tin-zinc alloy and what experience was shown for that particular type of application?

DR. LANCY: As far as I know, "whiskering" was never noticed with any alloys; it was always the pure metals which appeared to grow whiskers.

CHAIRMAN BRENNER: Of course, they had not plated those alloys at that time. Someone said the Bell Telephone Company may have done some work on this.

MR. R. A. EHRHARDT (Bell Telephone Laboratories, Murray Hill, N. J.): As far as I know, practically everything will grow whiskers under ideal conditions. However, I think it is probable that the purer metals are more likely to grow whiskers than the less noble metals. Work is still in progress and no report on it can be given at this time.

CHAIRMAN BRENNER: Have you any explanation of this particular phenomena?

MR. EHRHARDT: No, none that we can report.

MR. A. G. SPINDLER (Evansville Plating Works, Evansville, Ind.): Would black chromium over bright nickel or white brass produce a black finish?

MR. QUAELY: I have not tried it over polished or bright nickel surfaces. Black chromium has been tried on various types of brass and black finishes were obtained in all cases.

MR. SPINDLER: Did you put black chromium over white nickel?

MR. QUAELY: I have not tried that.

MR. SPINDLER: Do you think it has possibilities?

MR. QUAELY: It should be all right. The only trouble we had was plating directly on aluminum and some of the high manganese alloys.

MR. W. B. STEPHENSON, JR. (General Electric Company, Evendale, Ohio): In the plating of electroless nickel, what concentrations of the side reaction products such as phosphate or neutralized hydrochloric acid will cause the plating action to cease? Is there any regeneration process to reactivate the solution?

CHAIRMAN BRENNER: As to your first question: the reaction products are phosphites which build-up in concentration with no particular effect. For example, we have taken a new bath, added 100 g/l of sodium phosphite and found very little effect. It is possible that phosphite might increase the phosphorous content in the deposit or might slow down the rate of deposition, but there seems to be no considerable deleterious effect.

The acid concentration is rather critical because unless one keeps the *p*H in the best range, the deposits become poor in quality. Too, I think the rate of deposition would fall off at the higher acidities, but as I have not experimented in that range, this is conjecture.

MR. STEPHENSON: As the acid is neutralized by the addition of sodium hydroxide, will the resulting salt build-up finally stop the reaction?

CHAIRMAN BRENNER: No. Only minor effects as I have just mentioned.

If you add nickel as nickel chloride, then sodium chloride will accumulate in the bath. I don't believe this will have much effect. In answer to one of your questions, I don't know of a satisfactory way of eliminating the phosphite from solution economically. We have tried to do this by ordinary precipitation methods. It is possible that ion-exchange methods might serve, but the value of the materials in the solution is so small it does not seem worthwhile. There are only a few cents' worth of chemicals in the solution, so it is really better to throw it away.

MR. RALPH D. WYSONG (Studebaker Corporation, South Bend, Ind.): Are there any data on corrosion resistance of electroless nickel?

CHAIRMAN BRENNER: The only data we have are on salt-spray tests which we ran. We found the coatings were similar to ordinary nickel coatings in protective value.

MR. WYSONG: In your paper of 1946 you stated that the coating contains nickel phosphide, and as the solution ages there is a build up of the phosphide. To what per cent can the phosphide be increased without a deterioration of the coating and does an old solution produce a coating having less resistance to corrosion?

CHAIRMAN BRENNER: I think not. The corrosion resistance of the deposit would increase as the amount of phosphorous in the coating increased, because nickel phosphide has very much more resistance to chemical attack than pure nickel. We have electrodeposited the same type of alloy from similar solutions except using phosphite instead of hypophosphite. Nickel phosphide alloy is quite resistant to chemical attack. For instance, after immersion in cold hydrochloric acid along with pure nickel deposits, the alloy will still be there long after the ordinary nickel has dissolved.[1]

MR. WYSONG: You made a statement on the increase in chlorides and possible decrease in *p*H. We have been using a solution for quite some time now and once in a while we run into corrosion, red rust on the surface. It is over a chromium alloy steel. We run into most corrosion on the surface of the coating within six to eight hours after plating. Could it be that the *p*H is off?

CHAIRMAN BRENNER: I do not know the answer.

MR. WYSONG: The coating is 0.0003 inch to 0.0004 inch thick.

CHAIRMAN BRENNER: Unless you didn't get adequate coverage. If the surface were not catalytic all over you might not get deposition of the electroless deposit.

MR. STEPHENSON: We have found in our work that the salt-spray resistance of electroless nickel is about equal to that of electroplated nickel, if the electroless nickel has been heat-treated. Usually we heat-treat around 500° for about an hour.

The gentleman who spoke of the blush rusting might find his trouble being in the surface condition of the metal. If it has been heat-treated and has scale on it which has not been perfectly removed, he might find

that he has a different surface before plating. This might give him a different character of plate.

MR. RAYMOND F. VINES (Dentists' Supply Company, York, Pa.): What are the disadvantages of very low and very high carbonate contents in gold, silver and copper cyanide baths?

MR. MODJESKA: The same objections to carbonates in base metal solutions (less noble metal solutions) apply to precious metals.

It has been found that without any carbonate present the deposit has a tendency to be more granular. That follows whether we have used a strike or whether we have gone into a bath with our work cathodic prior to its entry into solution. The apparent desirable minimum of carbonate in both gold and silver has been in the neighborhood of 15 grams per liter.

We ran test panels, as I mentioned, and when less than 10 g/l of carbonate were present in either the potassium or the sodium formulations in gold and silver baths, we did start out with a granular deposit. At 15 g/l and up to 30 and 40 g/l, we did have better smoothening. At high concentrations, say, 8, 10, 12 ounces per gallon, then we noticed an increase in polarization, a decrease in cathode efficiency, and particularly in the case of gold, a greater tendency toward sponginess.

It is only recently that heavy deposits of gold have been plated continuously. Many reports, particularly those older than the past ten years, show that; for heavy deposits of gold the article should be plated for one-quarter of the time, brushed, put back in the tank, etc.

We can follow the trend from intermittent, additive plating to the present continuous plating with closer control of our plating solutions and we find when the carbonate concentration increases we tend toward sponginess which definitely requires smoothing and brushing. During the War, in the silver plating of bearings it was observed that high carbonates made for a more porous deposit which did not machine satisfactorily. Frequently, the operator of the tank laid the blame to lack of adequate filtration, solution insufficiently cleaned, though the trouble was traced to high concentrations of carbonate.

Back to peacetime operations: We have definitely shown in decorative silver that high carbonates will favor the tendency for that bugaboo of the plater, spotting out.

MR. QUENTIN O. SHOCKLEY (Allison Division, General Motors Corporation, Indianapolis, Ind.): In regard to this carbonate damage to silver solutions, we thought during World War II that we should treat solutions when they reached 90 to 100 g/l potassium carbonate. Since the War, due to economy measures, we have backed off somewhat from our treatment process, and with soluble anodes, we have successfully operated silver solutions with potassium carbonate as high as 250 g/l; so we are somewhat confused by this reported tendency of having a more porous plate with high carbonate content. Frankly, we cannot go that high when we use insoluble anodes, since we do experience more porous deposits. Apparently, this reported porosity is related to polarization of the anode and poor corrosion of the anodes, allowing particles of silver to come off the anode, and subsequently to be deposited at the cathode. We believe this can be caused by high carbonate concentration; however, our most serious difficulties are caused by crystals of potassium carbonate precipitating when the potassium carbonate concentration rises above approximately 200 g/l.

In connection with high carbonate, I would like to comment on the proposal of using carbides to remove carbonates from silver solutions. We tested this in our laboratories and it looked promising. We then went to one of the country's leading manufacturers of bottled gas equipment and asked them to quote on a carbide generator in which we intended to use the silver solutions with high carbonate content in place of water, discarding the acetylene gas and the carbonate precipitate. They took the proposal under advisement and in a week or two came back saying they didn't want anything to do with it. Their laboratory told them there was danger of a formation of silver acetylides and that they knew copper acetylides to be spontaneously explosive and that it was theoretically possible silver acetylides would do the same thing; therefore, they didn't want anything to do with such an installation.

CHAIRMAN BRENNER: That's the first time I ever heard of someone who did not want to sell his products.

MR. JOHN W. HOLLAND (Arvin Industries, Columbus, Ind.): Does the black chromium process as described in this morning's session have any possibilities as a black finish on metal furniture? If so, would it be economical?

MR. QUAELY: We have not considered thus far the use of black chromium for its decorative properties although it is quite possible that it could be used for such. However, with the high current density that is used and the large size of your furniture, you would have a problem on generator capacity.

DR. E. B. SAUBESTRE (Sylvania Electric Products, Flushing, N. Y.): Mr. Modjeska gave a review this afternoon on recommended carbonate removal methods and after looking at them, I feel the majority of them are rather unsuitable for tin plating baths. Do you have any recommendations there?

MR. MODJESKA: We prepared both potassium and sodium stannate baths in our work, but unfortunately while we can show very satisfactorily quantitative precipitation of the carbonate, the tin comes out, too.

DR. ALLAN A. JANIS (American Optical Company, Buffalo, N. Y.): Mr. Quaely, how large a piece have you actually turned black and how long does it take to get a good optical black finish?

MR. QUAELY: We have coated some objects such as cylindrical anodes for electron tubes, about 1½ inches in diameter, about 4 inches long. A real black coating, quite thick was obtained. We plated for five minutes,

which was more than enough; inside of a minute it was black all over.

As for larger sections, we did some on sheet cylinders, too. We did not have occasion to plate large, odd-sized pieces. We tried something in the nature of 4 inches in diameter, by 6 inches in width, and in all cases we were able to obtain even coatings, that is, even to the eye and jet black all over. We have not gone into any larger sizes.

MR. CHARLES LEVY (Watertown Arsenal, Watertown, Mass.): Can anyone offer information on electroplating on titanium with any metal and particularly with chromium?

MR. KORBELAK: So little work was done in our studies of adherent plated coatings on titanium that the negative results that were obtained offer little in the way of information for others to follow.

MR. FLOYD MICKELSON (Motorola Radio, Chicago, Ill.): Does anyone know of a good reliable method of passivating 416 stainless steel? We have been having trouble with our passivating, using the conventional 20 per cent to 30 per cent nitric acid. Soon after the parts are out of the bath they rust.

MR. JANIS: The Army has adopted one method—they do not passivate.

CHAIRMAN BRENNER: Are you satisfied with that lack of answer?

MR. MICKELSON: That is exactly the answer I wanted.

MR. WALTER DENNEY (Belmont Casket Company, Columbus, Ohio): We do decorative plating, most of it is silver, and before the War we had times when our silver was perfect, and again it would spot out within 12 to 24 hours after a piece was lacquered. After the War I thought we got away from that when I changed the arrangement of the tanks. I got some new hot water tanks, got a glass tank, and thought we had the best thing. Things went well for about a month and then the spotting started again. Usually the spotting happens when it starts to rain, when there is a lot of moisture in the air. A couple of years ago I put in a hot cyanide tank—that has a lot of fumes. Whether these fumes and the moisture in the air cause this spotting, I don't know. I have tried every way and contacted quite a few people to find out what I should do. I made acid dips, I used sulfuric acid. After we come from the silver tank, we go into the catch tanks, then into a cold water rinse and then into a sulfuric acid dip (it has about 10 per cent sulfuric). After it is dry, it is scratch brushed and lacquered. The next day when we go to assemble it, it is spotted, so we have to do this all over.

I wonder if there is anyone here who has an answer.

CHAIRMAN BRENNER: Isn't this rather a question for the Weather Bureau?

MR. DENNEY: We have a pretty good weatherman in Columbus, but I don't think he can help.

CHAIRMAN BRENNER: This is spotting out under lacquer?

MR. DENNEY: When I wash the lacquer from silver I have been using a 5 inch pumice stone. Usually when we run a color job, we shine it up with the same kind of brush wheel, with just plain water and never have any of that spotting. But anything that has a matte finish spots out with a brown spot. Washing the parts, then a cyanide dip removes the spotting.

MR. MODJESKA: Bureau of Standards Report, 1928, gave some data on this problem.

CHAIRMAN BRENNER: I think that study showed some of the symptoms—I think it was sulfur but I don't think it was a complete answer.

MR. MODJESKA: I think I am correct in the year—1928, that the Bureau of Standards report referred to the spotting out problem. That problem is not limited to cast hardware; I think you will find a great, sympathetic group among the lamp manufacturers and the picture frame manufacturers.

One of the suggested treatments has been a dichromate dip. I believe the concentrations employed have been in the neighborhood of 16 oz/gal, either sodium dichromate or chromic acid with a trace of sulfuric, and that definitely has seemed to prevent the formation of black spots. But, unfortunately, we tend to get a pink film, so the follow-through on that was to go through the chromic acid, then follow it with a dilute sulfuric dip; thus far we have not had any repetition of the trouble, but I certainly would not want to offer that as a panacea. It has worked in the cases we have tried, but we are far from accepting it as the cure-all.

MR. FRED FULFORTH (Philadelphia Branch, A.E.S. Educational Sessions Chairman): Before Dr. Brenner brings this meeting to a close, I would like to thank, on behalf of the Philadelphia Branch, all the members of the audience who have attended this Question Period tonight. It was questionable whether we should attempt it or not, but I am happy we did as we have a large number present—128 and 14 experts.

CHAIRMAN BRENNER: I think the experts up here certainly should be congratulated on the very skillful way in which they have answered all these questions from the audience. On the other hand, I think the audience should be commended on the very patient way they have listened to the answers.

DR. BROWN: On the last problem, I think it might be worthwhile to try this experiment and check the results by comparison tests in a humidity cabinet or even in a salt-spray. It is an old idea. Use about ½ oz/gal of chromic acid or bichromate in the final hot water rinse before drying and lacquering the clean buffed or satin-finished brass, silver or copper surfaces. Bichromate or chromic acid dips even when giving invisible films tend to retard white corrosion of zinc and to slow-up the tarnishing of silver, brass and copper from sulfide and ammonia fumes. The chromate film also improves the adhesion of the lacquer.

AN ELECTRONIC THICKNESS GAGE*

ABNER BRENNER† AND JEAN GARCIA-RIVERA‡

Abstract

An electronic thickness gage based on the skin effect is described. The instrument measures the thickness of coatings on metals provided the conductivities of the coating and basis metal differ sufficiently. Measurements can be made on combinations of metals regardless of whether they are magnetic or nonmagnetic. Measurements are nondestructive, so that the entire production of a plant could be tested if need be. No calculations are involved in using the gage since calibration curves are readily obtained by the use of samples of known thickness. The thickness of coatings that can be measured depends on the frequency of the exciting current used. A frequency of 2 megacycles is used for coatings up to 1.5 mils thick and a frequency of 100 kilocycles is used for coatings up to 6 mils thick. The instrument also can be used for measuring the resistivity of metals. This fact has possible application for sorting metals, and for controlling the purity of metals and the composition of alloys.

Introduction

The metal industries produce a large number of metal products which are clad or coated with another, usually more expensive metal, to obtain special surface properties such as corrosion resistance, wear resistance, or improved appearance. These coatings are produced by various methods, most important of which are electrodeposition, hot-dipping, cladding, and spraying. For controlling the thickness of the deposit, and for inspection purposes, reliable and rapid methods of measuring the thickness of the metallic coatings are necessary. A considerable number of methods exist and almost every property of metals is utilized. They include chemical, mechanical, optical, microscopic, magnetic, X-ray, spectroscopic, and radioactive methods, each of which has certain particular fields of application, although there is considerable overlapping.

The most desirable type of thickness measuring device is one which is nondestructive and direct reading. Few of the many methods which have been developed come within this category. The magnetic methods are used most widely, but since they are limited to combinations of coatings and basis metals, at least one of which is ferromagnetic, they are not applicable to many combinations of metals. A beta-ray[1] and an X-ray thickness gage[2] have been developed for measuring the thickness of different types of coatings, either metallic or nonmetallic. They are nondestructive and capable of fairly general application. However, they are not used widely because of their size and cost. Both of these devices are expensive, the beta-ray gage costing several thousand dollars, and the X-ray unit about fifteen thousand dollars, and therefore are suitable only for manufacturing plants where the high cost of the instrument is warranted by the large volume of the production. The beta-ray gage has the disadvantage that an area about 3 inches in diameter is required. This limits its use to large objects. In practice, the beta-ray and X-ray gages are most useful for continuously gaging the thickness of sheet materials as they pass along a production line.

It was desirable to develop an instrument which would measure the combinations of metals not covered by the magnetic type of thickness-measuring instruments. A number of years ago the possibility was envisioned of using a phenomenon known as the skin effect for measuring the thickness of metallic coatings. This would involve making use of the interaction of induced eddy currents and a coil. Although some preliminary work had indicated the practicability of the method, no real progress was made until a grant was obtained from the Office of Basic Instrumentation of the NBS in 1951**. The grant was made to develop an instrument which would measure the thickness of

---

*Presented at the Fortieth Annual Convention of the American Electroplaters' Society, June 17, 1953.
†Chief, Electrodeposition Section, National Bureau of Standards, Washington, D. C.
‡Chemist, Electrodeposition Section, National Bureau of Standards, Washington, D. C.
**Project supported by the Office of Basic Instrumentation of the National Bureau of Standards, and the Bureau of Engraving and Printing of the Treasury Department.

coatings on basis metals, neither the coating nor the basis metal being magnetic, for example, such combinations as tin on copper, silver on brass, copper on zinc. The instrument should meet certain requirements: (1) The measurements should be nondestructive so that the instrument could be applied to the complete inspection of the output of a factory if desired. (2) The instrument should be direct reading and give a rapid measure of the thickness. (3) The instrument should be capable of measuring the local thickness of a coating, that is the thickness at a point or over a small area, but not the average thickness of an area such as is given by the common chemical stripping methods. (4) The instrument should be portable so that an inspector in the field could readily carry it with him for checking the output of a plant. (5) The measurements should be fairly independent of the shape of the object measured.

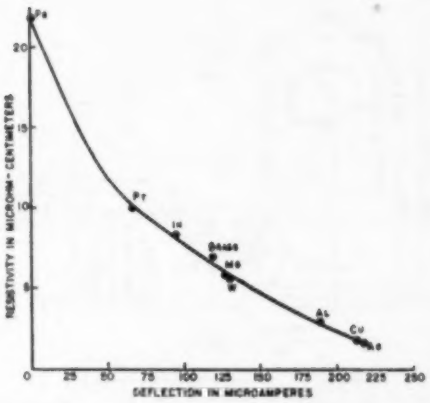


Fig 1. Relationship between meter readings and resistivity of metals using a frequency of 2 megacycles

Principle of Operation

An eddy current induced in a metallic surface can be limited to a thin surface layer by using a high frequency current. The thickness of this layer, which is usually referred to as the depth of penetration of the current, is inversely proportional to the square root of the frequency of the current and directly proportional to the resistivity of the metal. For a given frequency, the magnitude of the eddy current induced in a surface layer will depend upon the conductivity of that layer through which the current flows, other factors being constant. If the coating and the basis metal have different conductivities, the effective conductivity of the composite surface layer, and hence the magnitude of the induced eddy current, will depend to a large extent upon the thickness of the coating.

The magnitude of the eddy current is measured indirectly through the effect of its magnetic field which opposes that of the inducing current. The opposition of the two magnetic fields lowers the impedance of the probe coil thus permitting more current to pass through it. The changes in current through the probe coil are measured with a suitable instrument in series with it. Thus the measurement of the conductivity of a metal or of the thickness of a coating is reduced to the measurement of a current. Measurements of the eddy current effect on metals of different conductivity are shown in Fig. 1.

In practice no calculations are required for measuring thickness, as calibration curves are used which are made with specimens having known thicknesses. Each pair of metals requires an individual calibration curve. Calibration curves have two limits: one being the reading of the meter with the probe on the bare basis metal, the other being the reading with the probe on a thick layer of metal composing the coating, the layer being thicker than the depth of penetration of the current. Typical calibration curves are shown in Fig. 2. The difference in the readings in microamperes between the two metals is referred to as the interval, and all readings on the coated metal are based on the percentage of this interval.

Previous Work

The use of induced currents in measuring instruments is not new, as such instruments have been used for measuring the conductivity of metals and for detecting flaws in metals. However, the use of the skin effect for measuring the thickness of coatings apparently had not been described previous to the beginning of the NBS work. As a matter of fact, in the earliest stages of the development of the NBS instrument, it was not at all apparent that an instrument of satisfactory sensitivity and accuracy could be based on the skin effect. Recently a German instrument has been announced[3,4] for measuring the thickness of coatings. In the publication little information was given con-

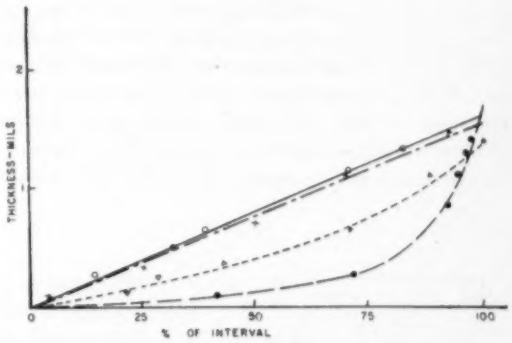


Fig. 2. Typical calibration curves obtained at 2 megacycles for different combinations of coatings and basis metal. ○Silver plated yellow brass; xNickel plated yellow brass; △Nickel plated mild steel; ●Copper plated mild steel. The inductance of the probe used was about 8 microhenries, the capacitor about 0.0008 microfarad. The interval silver to brass was 200 microamperes, all others 400 microamperes

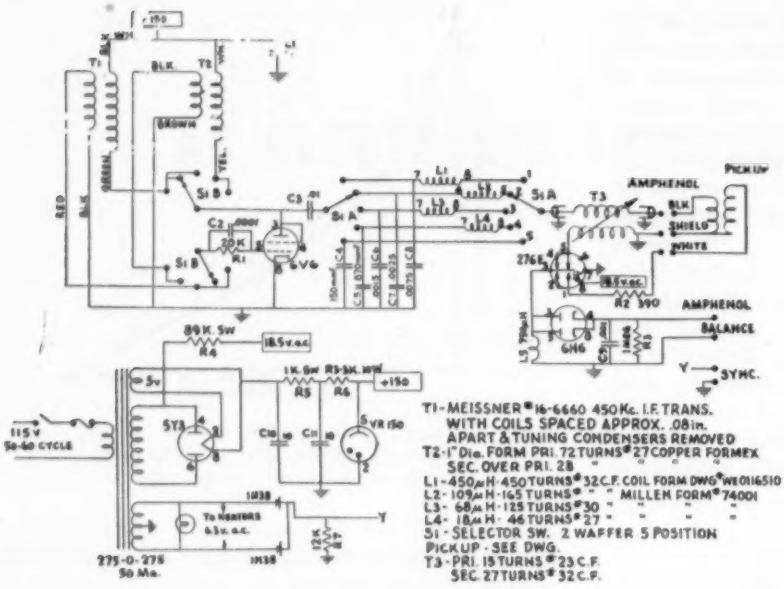


Fig. 3. Instrument for measuring thickness of metallic coatings by means of skin effect—circuit diagram

cerning the circuits and the principle of operation. Also recently, an instrument was developed in the Electronics Division of the NBS for the specific purpose of measuring the thickness of silver on stainless steel wave guides. Its operation is based on the measurement of a phase angle which varies with the effective conductivity.[5]

In the initial stages of NBS work an attempt was made to obtain indications of the validity of the proposed method by using two coils: one connected to an oscillator for inducing the current in the metal surface, and the other a pick-up coil in series with a sensitive galvanometer and a rectifier. Although this arrangement is similar in some respects to the circuit which was finally evolved, no satisfactory results were obtained for reasons which will be apparent later. The next stage in the investigation was to test the value of the thickness gage developed by Alexander, King, and Dinger[6] for measuring the thickness of paint films. With an instrument of this type and with an oscilloscope as indicator small effects were obtained with silver coatings plated on a nickel brass base.

The first successful results were obtained with an instrument designed for the authors by M. L. Greenough, B. K. Hawes and W. E. Williams of the Electronics Division of the Bureau. Although this instrument which was demonstrated to a meeting of the Office of Basic Instrumentation in April, 1951 was superseded by a later design it is of sufficient interest to be mentioned in detail. The circuit is given in Fig. 3. Essentially it was an oscillator capable of furnishing several frequencies ranging from 100 to 2000 kilocycles and was provided with a mutual inductance probe. A 60 cycle mercury switch, alternately switched the voltage of the secondary probe coil and the reference voltage of a standard coil on to an oscilloscope. The indication consisted of two horizontal lines. With the probe placed on the basis metal, the instrument was balanced until only one line was observed. When the probe was placed on a coated specimen, the degree of unbalance was shown by a separation between the two horizontal lines. This instrument showed that the thickness of metallic coatings could be measured with considerable sensitivity. Furthermore, the instrument was very valuable in indicating the factors that required further development. Since direct readings on

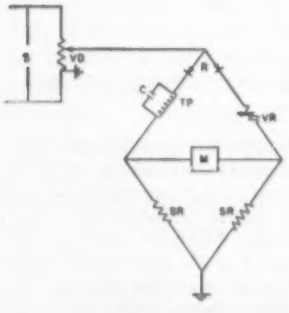


Fig. 4. Bridge type circuit for thickness gage.

S —*Oscillator as the power supply; output, 6 watts*
VD—*Voltage divider, a potentiometer of resistance from zero to 1000 ohms*
R —*Germanium rectifiers, Sylvania In-38*
SR—*Carbon resistances of 100 ohms each*
M —*dc meter 0–500 microamperes*
VR—*Potentiometer, helipot type, 0–100 ohms*
TP—*Test probe. Size varies with the frequency used. Typical values are: 50 turns of No. 40 copper wire for 2 megacycles and 300 turns for 100 kilocycles*
C —*Mica type condenser. Its value has to be that required for resonance with the probe. For example, 0.0009 microfarad for 2 megacycles and 0.008 microfarad for 100 kilocycles.*

a scale were desired, and since the reproducibility of the readings was not satisfactory, additional circuits were investigated.

Circuits

After a large number of circuits had been tried, two were finally selected. Fig. 4 shows the bridge type of circuit. The power supply S is a commercial type of oscillator with an output of 6 watts. The amount of current through the circuit is controlled by means of the voltage divider VD. The two germanium diodes R permit the current to flow in only one direction, so that only half of the current cycle is used. The variable resistance VR is used to balance the circuit. The test probe TP has an appropriate condenser C across it. The resistances SR, which form two arms of the bridge, are about the same resistance as the probe. The meter M is a direct current microammeter with a range of 500 μa.

Fig. 5 shows the branch type of circuit now in use. The power supply is the same oscillator. Again the current through the circuit is controlled by the voltage divider VD. The diodes R now are in opposite phase and thus current alternately passes through each leg of the circuit. The test probe TP with the capacitor C across it is balanced by the variable resistance VR. The direct current microammeter M is in series with the parallel circuit. During half of the cycle the current passes through the test probe and the meter, during the other half through the variable resistance and meter, but in opposite direction. The meter registers the difference of these two currents.

With either circuit, the meter is made to read zero when the probe is placed on a reference surface. When the test probe is placed on the metallic surface to be tested, the resulting change of inductance is indicated by the meter reading, which depends upon the conductivity of the metallic surface layer through which the induced current flows.

These circuits are very simple, but they have to meet two requirements without which they would have no usable sensitivity. They are: (1) the circuit must be resonant. A capacitor of appropriate value must be placed across the probe otherwise no sensitivity at all will be obtained. (2) The size of the probe coil must be fitted to the frequency. Unless a coil of suitable inductance is used, no value of capacitance across it will result in giving sensitivity.

The two circuits, Figs. 4 and 5, may be considered to be operating with a pulsating direct current which has a dual action. Since the current has a time rate of change it shows the ordinary characteristics of alternating current with respect to inductances and in addition has the ordinary characteristics of direct current in operating a d'Arsonval type of measuring instrument.

Frequencies Used

The range of thickness which can be measured by the instrument depends on the frequency used. The depth of penetration, D, of the current is given by the equation

$$D = K \sqrt{\frac{R}{Mf}}$$ where K is a constant; R is the resistivity of the metal; M is the magnetic permeability and f is the frequency of the current in cycles per second. This means that high frequencies are most suitable for measuring thin coatings accurately, but that such frequencies would be of no value for measuring coatings thicker than the depth of penetration.

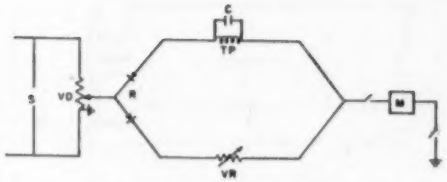


Fig. 5. Branch circuit. For legend, see Fig. 4

During the development of the instrument a large number of different frequencies were used. However, with a frequency of 2 megacycles most coatings up to 1.5 mils can be measured accurately, and with a frequency of 100 kilocycles coatings up to 6 mils can be measured, although at the latter frequency, measurements of thin deposits are not so accurate as at 2 megacycles. In Fig. 6 calibration curves are given for copper on steel at both of these frequencies. It seems obvious that thicker deposits can be measured by the use of lower frequencies. However, lower frequencies require larger probes, which introduce some difficulties as will be shown later.

Test Probes

Early in the authors' work it was found that in order to diminish the effect of geometry of the object on the measurement, the diameter of the probe must be

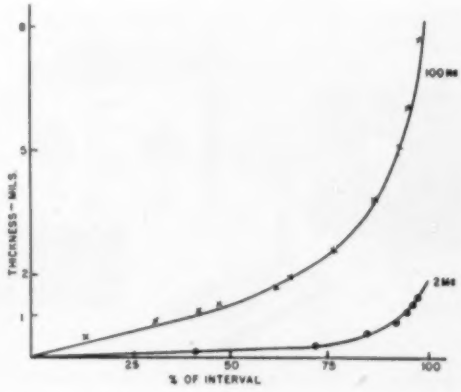


Fig. 6. Effect of frequency on the range of thickness of coating that can be measured—copper on steel

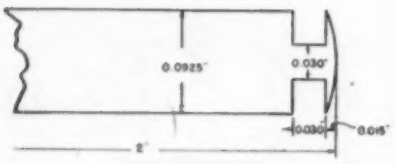


Fig. 7. Typical dimensions of bobbin used at 2.5 megacycles

small. This fact apparently is a deterrent to the use of very low frequencies which require large coils. Coils may be made smaller if a ferromagnetic core is used, but they are unsuitable because they are sensitive to magnetic fields. The Q value of the coil in the test probe is related to the sensitivity obtained. For each frequency an optimum value exists which yields the maximum sensitivity. The range of frequencies over which a given probe can be used is limited. For example, a probe giving good sensitivity at 100 kilocycles cannot be used at 2.0 megacycles. Satisfactory probes can be made of Lucite or Bakelite. Typical dimensions are shown in Fig. 7. About 50 turns of No. 40 copper wire are required for a probe for use at 2 megacycles and about 300 turns for use at 100 kilocycles. The coils are cast in a resin for sturdiness and stability. An illustration of a probe along with the measuring circuit and oscillator is shown in Fig. 8.

Sensitivity

The interval or difference in reading between a basis metal and the metal composing the coating depends on the difference in their conductivities and magnetic permeability. The sensitivity of the instrument is defined arbitrarily as the difference in reading between a sheet of copper and a sheet of ordinary yellow brass, using about 20 milliamperes in the circuit as measured by a thermocouple meter. Sensitivities of 400 microamperes or more have been obtained. A sensitivity about 50 microamperes corresponds to an interval of 400 microamperes between copper and steel.

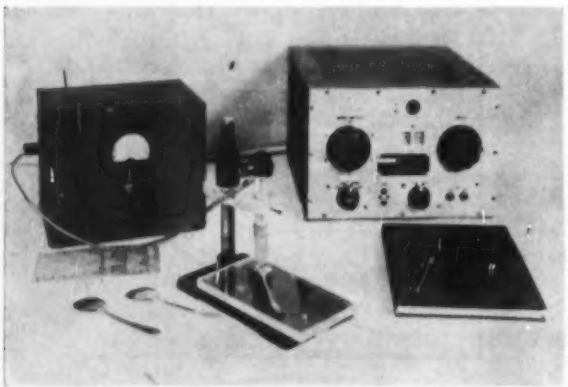


Fig. 8. Thickness gage, showing probe mounted on a stand, case containing the branch circuit (on left) and oscillator (on right)

Calibration of the Instrument

Two methods of taking the measurements have been investigated.

Direct Contact Method

The test probe is placed in contact with the surface of a bare specimen of the basis metal and the instrument is adjusted to read zero. The probe next is brought in contact with the coated metal surface and the reading on the meter is noted. The thickness is obtained from a calibration curve prepared in a similar way by the use of samples of known thickness. This method proved to be very much affected by dirt on the sample, geometry of the object, and inclination of the probe.

Peak Method

The probe first is brought near the surface of a bare piece of basis metal and then raised slowly. At first the needle will move in one direction, but eventually the needle will stop moving and begin to retrace, that is, the reading goes through a peak value. The instrument is adjusted so that the peak occurs at the zero reading. The probe then is placed on the sample to be tested and raised slowly until the peak reading is obtained. The reading is noted. The thickness is read from a curve prepared in this way by the use of standard samples. This method has been adopted for all measurements, except for coatings of nonconductors on metals or of poorly conducting metals on highly conducting metals such as lead on copper and paint coatings on metals, which require the contact method. Measurements by the peak method are more reproducible than those made by the contact method. The effect of small amounts of dirt on the sample, of moderate surface roughness, and the effect of the geometry of the object are greatly reduced by the peak method. The calibration curves shown in Fig. 2 were prepared by the peak method. It may be noted that although the instrument was designed primarily for combinations of nonmagnetic metals, equally good results may be obtained with magnetic combinations such as nickel on steel both of which are magnetic and with combinations such as nickel on brass in which one metal is magnetic.

Effect of Curvature

Although the use of the peak method in taking the readings has greatly reduced the effect of the geometry of the object tested, this difficulty has not been obviated completely. The errors can be very large, especially when the radius of curvature is less than 1 inch, or when the thicknesses measured are very small. As an example, it has been found that the reading obtained with a one-inch diameter brass cylinder is about 70 microamperes less than that obtained on a flat piece of brass, when the sensitivity of the instrument is 200 microamperes. The difference increases very rapidly as the diameter decreases. This difference also

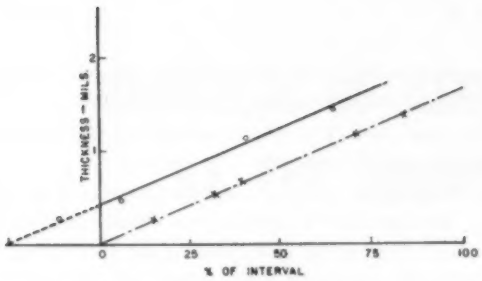


Fig. 9. Relative position of the calibration curves for silver-plated yellow brass when no correction is made for the geometry of the object

○*Cylinders, one inch in diameter*
x*Plane samples*
The interval was about 200 microamperes in both cases

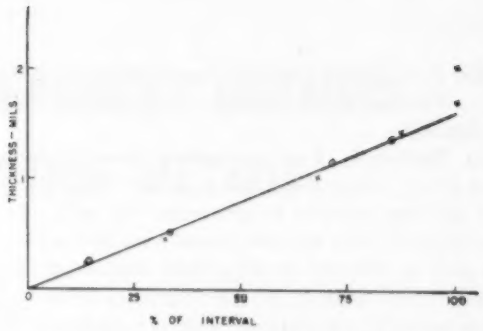


Fig. 10. Relative position of the calibration curves for silver-plated yellow brass when a correction is made. A bare, one-inch, brass cylinder was used as the zero reading for the cylindrical specimens. A bare, plane, brass piece was used for the plane samples

x*Cylinders, one-inch in diameter*
○*Plane samples*

varies with the metal in question, for example, the effect of curvature is much less with steel samples. Fortunately, the net effect of the curvature seems to be a uniform displacement of the whole calibration curve, so that satisfactory results can be obtained by the use of a similar uncoated object for the zero reading.

To determine the effect of curvature, different thicknesses of silver were plated both on plane and on one-inch cylindrical samples of yellow brass. Curves were made by the use of both sets of samples. Fig. 9 shows the displacement of the curve when no correction is made for the curvature of the cylinders. Large errors would result if the calibration curve for flat specimens were used in conjunction with measurements made on curved surfaces. For example, a cylinder one inch in diameter plated with about 0.4 mil of silver reads the same as an unplated flat brass sample.

Fig. 10, however, shows the similarity of the two curves when an unplated cylinder one inch in diameter is used as the zero reference point for the cylindrical specimens, just as a flat sheet of brass is used as the zero reference for flat specimens. Thus, if the instrument is brought to zero by the use of an unplated similar object, the effect of curvature is eliminated and the calibration curve prepared with flat standards may be used.

Future Work

Frequency

The study of the range and sensitivity of the gage at various frequencies on different metal combinations has not been completed. If time permits, the depth of current penetration and the range of possible thickness measurements of the gage are to be determined down to 60 cycles. The lowest frequency which has been reached so far, with any sensitivity, is 200 cycles. The use of the lower frequencies brings along some new problems, for example magnetic cores may be required in the probe coil.

Absolute Calibration

Another problem which is being investigated is one involving the possibility of making measurements of thickness without the use of prepared standards with which to calibrate the instrument. When this instrument was first envisioned, it was with the idea that thickness of coatings could be determined by using a range of frequencies. This seems to be a definite possibility, since the depth of penetration of the current varies with frequency. Theoretically, it would be necessary only to change the frequency until a frequency was found at which the basis metal ceases to have any effect on the readings. The practical difficulties in such a measurement are that one probe can not be used over a sufficiently large range of frequencies. However, it is possible that a sufficient range of frequencies can be covered with two or three probes.

Acknowledgments

Acknowledgement is made to B. Wagonner who participated in designing the circuit, R. Hill who assisted in the improvement of the original design and to M. Greenough of the Electronics Division for his frequent advice on technical details of electronics.

References

[1]Manufactured by Tracerlab, Boston, Mass.

[2]Manufactured by General Electric Co., Schenectady, N. Y.

[3]Industrial Use of Eddy Current Testing, W. A. Cannon, Jr., Non Destructive Testing, May 1953, p. 30.

[4]F. Forster, Metall *7*, 320 (1953).

[5]Sheet and Plated Metal Measurements with a Phase Angle Type Probe. Paper presented by W. A. Yates and J. L. Queen at the A.I.E.E. summer general assembly in June, 1953, Atlantic City.

[6]Ind. Eng. Chem. Anal. Ed. *17*, 389 (1945).

MR. RAY VINES (Dentists Supply Company, York, Pa.): What is the effect of stress in the base metal and the deposit?

DR. BRENNER: I do not believe stress would have much effect, unless the metals were ferromagnetic. We have not had occasion to determine this with any degree of detail, but we have found that stressed nickel will give a different reading than unstressed nickel. This difficulty depends on the properties of nickel and will occur with any type of sensitive electrical measuring device. One means of overcoming the difficulties would be to subject the specimens to an annealing treatment.

MR. L. M. MORSE (Chrysler Corporation, Detroit, Mich.): I would like to ask Dr. Brenner and Mr. Garcia-Rivera to put a sketch on the board on the construction of the loop probe, if possible.

(Sketch was drawn on the board as requested.)

DR. BRENNER: The tip of the bobbin must be very thin so that the end of the coil will be fairly close to the sample. This increases the sensitivity of the contact method. There is nothing particularly difficult involved in making the probe. Resin is cast around the coils, so that the whole assembly is perfectly rigid.

Does that answer your question?

MR. MORSE: Is this chromium-plated metal?

DR. BRENNER: The core of the bobbin is made of nonmetallic material. We can use a plastic but for the purpose of rigidity we use sapphire rods which have been machined into the form of a bobbin.

MR. J. TERES (U. S. Air Force, Wright Patterson Air Force Base, Dayton, Ohio): By using the contact method, could this instrument also be used in a manner similar to the "Film Meter" to measure paint and nonconducting coatings as well on metals?

DR. BRENNER: Yes. We did not emphasize that point, but the contact method must be used for measuring the thicknesses of a nonmetallic material on a metallic base.

MR. E. V. COLLINS (Chromium Corporation of America, Waterbury, Conn.): What is the accuracy of this instrument in measuring nickel over steel?

DR. BRENNER: We have not fully investigated the accuracy. A number of variables must be taken into account, for example, the roughness of the surface, the properties of the metal and the geometry of the object. I think the instrument would be precise to probably plus or minus 5 per cent of the measurement. The sensitivity of the instrument, however, is considerable; in absolute units, it would probably indicate a coating a few hundred-thousandths of an inch thick.

MR. COLLINS: How about measuring the thickness of chromium over nickel?

DR. BRENNER: I do not believe that would be difficult. We are now developing an instrument for the Bureau of Engraving and Printing for measuring the thickness of chromium over nickel on steel printing plates.

MR. R. G. DREWES (Weston Electrical Instrument Corporation, Newark, N. J.): Can this device be used for measuring the intermediate coating, such as nickel under chromium, or copper under nickel?

DR. BRENNER: We have given the matter of composite coatings some consideration. I believe that they could be measured, but it would have to be done the way we did with magnets. That is, one would have a set of standards of composite coatings, comprising a series of different total thicknesses and different proportions of the various coatings. By using two different frequencies with a given probe and two sets of calibration curves, I believe that it would be possible to measure the thickness of the total combinations as well as the thickness of the individual layers.

MR. FRED BAUCH (Frigidaire Division, General Motors Corporation, Dayton, Ohio): This thickness gage measures the thickness by measuring the conductivity of the deposit. How will the conductivity of the various deposits affect the accuracy of the calibration? The gage is calibrated by means of a standard and I would like to know if the gage would have to be calibrated for each type deposit; deposits such as copper, tin, etc., and also of the same kind of deposit from baths of different composition and with varying impurities.

DR. BRENNER: I do not believe any difficulty will occur with most deposits. The density and conductivity of most electrodeposits does not vary to any large extent, with the exception of chromium which may show greater variations. Measurements of the conductivity of various types of nickel coatings showed that the conductivity does not vary to a great extent with the conditions of deposition.

MR. BAUCH: Can this gage be used also to check the thickness of anodized coatings?

DR. BRENNER; Yes; for the measurement of nonmetallic coatings on a metallic base, it has been quite satisfactory.

THICKNESS OF ELECTRODEPOSITED COATINGS BY THE ANODIC SOLUTION METHOD*

C. F. WAITE†

Introduction

With the advent of federal restrictions curtailing the use of nickel for decorative plating came the problem of substitute plating and the attendant thickness measurement problem. As decorative plating at the author's company was entirely interior hardware, plating chromium directly over copper sufficed to solve the first problem. The thickness measurement problem came when a customer complained of insufficient chromium on plated parts. After experimentation, it was decided that the hydrochloric acid drop test was not dependable for the measurement of chromium plating thickness upon copper. This left an urgent need of an accurate method of measuring chromium thickness. In investigating possible methods, the modification of the anodic solution procedure of measuring plating thicknesses developed by Dr. H. F. Francis of the Armour Institute was discovered[1]. After demonstrating through repeated tests, the accuracy of this method with an experimental test model, it was found that one equipment supplier was manufacturing a production instrument‡ which offered advantages in speed and versatility over the experimental model mentioned above. That instrument was purchased and has been used with excellent success in the routine measurement of the thickness of chromium plated upon copper. Its use has been extended to other plated coatings as well.

Difficulties with the conventional tests for chromium thickness will be described first in this report. Then details will be given on the application of the Francis modification of the anodic solution method for measurement of chromium over copper, and the later use of the commercial instrument for this purpose. Finally, there will be discussed the use of that instrument for other combinations of plated and base metals.

Discussion

Hydrochloric Acid Drop Test

When the customer's complaint of inadequate chromium thickness on some of the plated parts occurred shortly after the change to a chromium plate directly upon copper, determinations of the thickness of the chromium plate were being made by conventional methods. For the measurement of the thickness of chromium plated upon nickel, the author's company had always used the hydrochloric acid test described in the literature[2]. When this method was applied to chromium plated over copper very erratic results were obtained. Various methods of cleaning the sample were tried, but still the results were not reproducible. In an effort to prove or disprove the validity of the method, a number of 3 x 6 inch panels were plated. Half of them were copper plated and then chromium plated, and the other half were copper plated, nickel plated and then chromium plated. They were all chromium plated at the same time with the same current density. To avoid edge effect, a 2 x 3 inch portion was machined from the center of each panel. The chromium thickness on several of these 2 x 3 inch panels was measured by weighing the panels before and after stripping the chromium with hydrochloric acid. A quantitative analysis for chromium of the strippings of each panel proved that the weight method was reliable and that only chromium was stripped by the hydrochloric acid. This method of weighing a sample before and after stripping the chromium from a measured area with hydrochloric acid has been used from that time as an umpire method of measuring the thickness of plated chromium. Trials were made using the hydrochloric acid drop test to measure the chromium thickness on the remaining 2 x 3 inch panels. The panels with a nickel layer gave readings that were reproducible and were within ten per cent of the results obtained by the loss in weight method. The panels that had chromium plated directly on copper did not give reproducible readings. The tests indicated chromium thicknesses from 8 to 35 millionths of an inch on immediately adjacent areas of the panels. Thus it was decided to abandon the hydrochloric acid test as a means of determining the thickness of chromium plated directly on copper and to search for a more accurate test.

*Presented at the Fortieth Annual Convention of the American Electroplaters' Society, June 17, 1953.
†King-Seeley Corporation, Ann Arbor, Mich.
‡Electronic thickness tester, Kocour Company, Chicago, Ill.

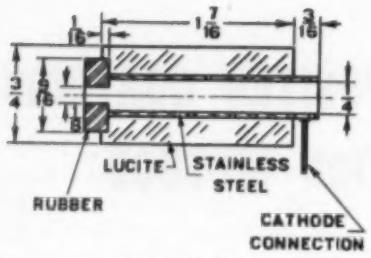


Fig. 1. Cell

Anodic Solution Method

An immediate inquiry was launched to discover a satisfactory test for measuring chromium thickness. Superficial investigation was enough to eliminate most standard test procedures. The magnetic method was not applicable and the thinness of the chromium prevented the use of the microscopic method or the chord method. An article in the May, 1948 issue of the "Journal of the Electrochemical Society", however, described a method which seemed to have possibilities. This article, entitled "An Electrolytic Thickness Tester for Plated Coatings", was written by Howard F. Francis of the Armour Research Foundation.

The method discussed in this article was a development of the coulometric method. Faraday's Law states that, "the quantity of any element (or radical) liberated at either anode or cathode during electrolysis is proportional to the quantity of electricity that passes through the solution". If there is 100 per cent current efficiency, it is therefore possible to calculate the weight of any metal which will be plated or deplated by a particular amount of electricity. The weight of metal is a function of its density, thickness, and area, and the amount of electricity is a function of the current and time during which it flows. Since the density is known, therefore, the time required to deplate a known area with a known constant current is a direct measure of the plating thickness. This "anodic solution method", therefore, provides an absolute measurement which does not depend upon an empirical calibration.

Its accuracy depends upon careful measurement of the variables noted above. An empirical calibration may be determined from standards of known plate thickness to avoid error introduction by a faulty measurement of the areas. The time necessary to deplate at constant current the known area is the variable in measuring thickness, and so it must be checked carefully. A change in voltage is used as an indication that the plated metal is entirely deplated from the base metal. An electrolyte must be selected such that the plated metal will dissolve anodically more readily than the base metal or, in other words, for such an electrolyte the plated metal is higher in electrochemical activity than the base metal.

Dr. Francis used a small current to insure 100 per cent current efficiency and this was held constant. He made use of a stainless steel cell and a rubber washer to limit the area to a known value. An ingenious system was used to record the time necessary to deplate the metal in question from the known area. An electric timer was started when a test began. A vacuum tube relay was actuated by the voltage change at the anode when the plated metal was completely deplated from the known area. This relay stopped the electric timer and automatically recorded the time necessary to deplate the plated metal.

Experimental Cell Design

In order to investigate this method an experimental cell was designed and made. This cell is pictured in Fig. 1. The stainless steel cylinder is pressed into the Lucite cylinder. The rubber washer fits snugly without deformation into the recessed portion of the Lucite. The rubber washer insulates the cathode, the stainless steel cathode cylinder, from the metal to be checked, which is the anode; and also defines the area to be stripped. It is therefore important that the area of the hole be measured as accurately as possible, and this is the only critical dimension of the cell. The washer used was placed on a comparator and blown up to fifty diameters to enable a more accurate measurement of the area. Current was furnished by a 90 volt dry cell with a large variable resistance in series with the deplating cell. A high voltage dry cell was used so that variations of the current, caused by variations of the voltage at the deplating cell, would be kept as small as possible. The emf of the deplating cell, and the time were recorded on a recording potentiometer*. A 10 per cent solution of sodium hydroxide was used as the electrolyte.

Test Procedure

To determine the accuracy of the experimental instrument chromium thickness standards were prepared. Several 3 x 6 inch panels were plated as described previously and 2 x 3 inch panels were machined from them. The loss in weight method was used on a number of these to determine the thickness of the chromium. The panels selected for this were carefully weighed and then painted on the back and edges with acid proof paint. Then they were immersed in hydrochloric acid until the chromium was stripped. After rinsing and drying, the acid proof paint was removed with thinner and after careful drying the panels were reweighed. The thickness of the chromium was assumed to be the same over the entire six square inches. The chromium thicknesses thus determined were assumed to be the same as those of the other panels plated with the same current density and at the same time.

Thickness determinations with the deplating cell then were made on these corresponding panels using a current

*Brown Instrument Co., Division, Minneapolis-Honeywell Regulator Co.

of 2 milliamperes in the cell. The potentiometer trace on its record automatically plotted the emf of the deplating cell against time. Time, as a variable, was read directly from the potentiometer record. The start of the deplating was recorded by the beginning of the trace as the deplating current was turned on. While deplating, the emf of the cell was nearly constant, but at the moment the deplating was complete, the emf rose sharply. Thus the time elapsed while deplating was in progress was read directly from the potentiometer record. Each calibration panel was checked several times. From the thickness determined by the loss of weight test, it was then possible to calculate the thickness of plate removed per unit of time. The calibration of the deplating unit with one particular rubber washer was 2.05 millionths of an inch of chromium for each minute of deplating time with a current of two milliamperes. This value agreed within 1 per cent of the value calculated from the equivalent weight, density, area, current, and time. The reproducibility of readings in the range of 8 to 20 millionths of chromium was within 5 per cent. The variation between these readings and the thickness by the loss of weight method for those panels was less than 5 per cent.

To determine if a smaller current was being used than was necessary, experimental runs were made using a current of 5 milliamperes and 2½ milliamperes. A current of 5 milliamperes gave results which were not always reproducible, and usually were slightly high. This was attributed to the fact that the current efficiency was not 100 per cent at 5 milliamperes. It was found experimentally that a current of 2½ milliamperes could be used. However, it was decided to use 2 milliamperes in production to be assured of 100 per cent current efficiency.

The anodic solution or coulometric method was adopted immediately by the inspection section for the routine checking of chromium plating thicknesses on production parts. It was found to be very accurate and satisfactory for this purpose. Shortly after the adoption of this anodic solution method to measure the thickness of chromium electrodeposits, announcements of a commercial instrument were noted. Thickness comparison tests were made using the two instruments and the results were found to be comparable.

Commercial Thickness Tester

The commercial thickness tester has a deplating cell similar to the experimental unit. It is made of stainless steel and uses a rubber washer to limit the deplating area. An electronic relay is used in conjunction with an automatic counter to measure the time of deplating. When the deplating current is turned on, the counter is automatically started. When the plated metal is deplated, the rate of change of voltage actuates the relay which turns off the instrument including the counter. The counter is calibrated directly in thickness units (millionths of an inch for chromium and hundred-thousandths of an inch for other metals). The electrolyte is agitated during deplating by the ingenious use of pulsating air which is the secret of its greater speed, as will be explained presently. The thickness of several plated metals can be measured by adjusting a dial on the instrument's front panel to the appropriate reading and then using the appropriate electrolyte supplied.

The commercial unit was found to have the advantage of speed—about thirty times faster—over the experimental one. In production, the author's company tries to hold the thickness of decorative chromium plate between 10 and 20 millionths of an inch. With the experimental unit it took approximately eight minutes plus set-up time to measure 16 millionths of an inch of chromium. The commercial tester was found to deplate about one millionth of an inch of chromium or about one hundred-thousandth of an inch of another metal per second. This is because the air agitation allows 100 per cent current efficiency at a higher current density. The author feels the commercial instrument is much more versatile than the experimental unit since it is designed to measure, by the use of appropriately furnished electrolytes, the thickness of chromium, silver, tin, cadmium, zinc, brass, copper, and nickel on steel; the thickness of chromium, silver, tin, cadmium, zinc, and nickel on brass or copper, and the thickness of chromium on nickel. Composite coatings, such as copper, nickel and chromium on steel, may be measured successively by changing the electrolyte solution without disengaging the cell from the sample.

Production Experience

It has been used successfully for about a year to measure the thickness of nickel and chromium on copper and chromium on nickel. For these measurements the anodic solution method is preferred over all others. The instrument has been used also to determine the thickness of cadmium, zinc and copper upon steel. It is believed to be more accurate than a magnetic type instrument* for these determinations; however, the latter is preferred because it does not damage the parts. The thickness of copper upon zinc die cast metal can not be determined by the anodic solution method because as far as is known, no electrolyte has been discovered in which copper will dissolve anodically more readily than zinc.

The thickness of nickel deposits over steel has been found by many to be difficult to evaluate by the anodic solution method. As this was a problem the author's company might shortly be facing, the thickness of nickel plated upon steel was checked by this method. Results were found to be erratic. The rate of change of voltage after the nickel was deplated from the steel was not great enough to actuate the relay and turn off the instrument even though the electrolyte was such

*Magne-Gage, American Instrument Company, Inc., Silver Spring, Md.

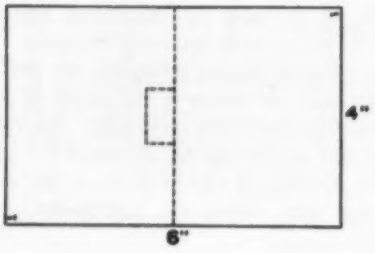


Fig. 2. Test Panel

that the nickel dissolved anodically more readily than the steel upon which it is plated. The results indicated that the nickel thickness could be measured if it were plated upon copper, but not if it were plated upon steel. To prove or disprove this point, another set of experimental panels were plated. These panels were cold rolled steel and were 4 x 5 inches. They were numbered in opposite corners as shown in Fig. 2. Twelve panels were copper plated and twelve were unplated steel. All 24 panels were placed in the nickel tank and plated at 50 asf. At the end of one minute, 3 of the copper plated and 3 of the unplated steel panels were removed. At the end of 4, 20, and 60 minutes, this procedure was repeated. Thus, there were produced 3 copper plated steel panels; 3 steel panels plated with 1 minute of nickel; 3 of each with 4 minutes of nickel; 3 of each with 20 minutes of nickel; and 3 of each with 60 minutes of nickel. Two samples of each type were selected and cut in half as is shown by the dotted line in Fig. 2. A piece about 1 x ½ inch was cut from one half of each sample as illustrated in Fig. 2. These small pieces were mounted in bakelite, polished, and the nickel thickness was measured microscopically. The nickel thicknesses did not vary with the base metal and are tabulated in Table 1. These values were considered to be the same as the nickel thickness of the adjacent edges of the corresponding samples. The nickel thicknesses in these areas were then measured with the commercial anodic solution type measuring instrument. The thicknesses of nickel plated upon copper are shown in the above table. The amount of nickel on the one minute panel is not shown because it was below the minimum limit of accuracy of the instrument, which is 50 millionths of an inch for all metals except chromium and 5 millionths of an inch for chromium. The percentage of error of these values compared to those determined by the microscopic method is also tabulated. The range of values for each panel was about equal to the error. The thicknesses of nickel plated upon steel could not be determined on the commercial anodic solution tester with the electrolyte available during the test period noted above.

TABLE I. RESULTS OF THICKNESS MEASUREMENTS

Plating Time (Minutes)	Nickel Thickness* (On Copper or Steel) Microscopic Method	Nickel Thickness* (On Copper) Anodic Solution Method	Per cent Error
1	0.000030	—	—
4	0.000110	0.000100	9
20	0.000490	0.000480	2
60	0.001480	0.001465	1

*Values given in inches.

One possible reason for this difficulty was that the rate of change of voltage across the cell when deplating was complete was insufficient to actuate the relay of the instrument. To confirm this, a recording potentiometer was placed in the circuit to record any change in voltage and the time at which the change in voltage occurred. This indicated a small change in voltage and also provided a positive measure of the time which did not depend upon the rate of change and satisfactory results were obtained. Passivity was also considered to be a cause of faulty readings in the determination of nickel thickness on any base metal. Any electroplater can testify to the difficulty of preventing nickel plate from becoming passive. If this occurs during deplating, it will give the nickel an apparent thickness greater than it actually is because the current efficiency at the anode is not 100 per cent.

The difficulty experienced with nickel thickness determinations over steel was reported to the supplier who in turn, furnished a sample of a new electrolyte for future trials. Experiments with the nickel plated panels were repeated using the new electrolyte and were wholly successful. With it, it was possible to measure the thickness of nickel plated on either steel or copper within five per cent.

Conclusion

In summation, it has been found that the anodic solution method can be used successfully to measure the thickness of electrodeposited coatings of copper, zinc, cadmium and nickel upon steel, the thickness of chromium and nickel upon copper and the thickness of chromium upon nickel. For the determination of nickel upon steel, chromium and nickel upon copper, and chromium upon nickel, the author prefers to use the anodic solution method for accuracy and convenience over the drop test or magnetic methods. For the determination of cadmium, zinc, and copper upon steel, the magnetic method is preferred because it does not damage the parts. At present, the author knows of no electrolyte by which the thickness of copper plated upon zinc die castings can be determined using the anodic solution method. In general, the thickness of any metal plated upon any other metal can be found by this method if an electrolyte is obtainable in which (1) the first metal will dissolve anodically more readily than the second, or (2) the metals exhibit different potentials.

UNICHROME
Trade Mark

News about
COATINGS for METALS
Metallic . . . . . Organic . . . . . Decorative . . . . . Protective

The 1953 way to chromium plate

WHAT PLATERS LOOK FOR IN RECTIFIERS

All platers want a DC supply to be dependable, equipment durable, and capacity close to needs in order to avoid extra investment.

Designed specifically for platers, in a line unsurpassed for completeness, Unichrome Rectifiers permit virtually a "custom" rectifier installation. Included are standard units, plus-rated units, extra heavy duty units and water-cooled units —available in sizes from 250 to 10,000 amperes in 250 ampere steps and with various controls. Full data available.

What to look for in chromium plating anodes

Quality of chromium plating anodes can be gauged by several important factors.

First is composition of the anode. If it's tin-lead alloy, it better resists corrosive action of chromic acid during both idle and active periods.

Then check the bond between body and copper hooks. Best conductivity results when hooks are tinned, alloy cast to the hook, and anode body then fused on.

Finally, observe the hook. Does it assure good contact with a knife-edge wedge-type hook that cuts through encrustations on anode bars?

Providing users with all these advantages, Unichrome Anodes for chromium plating make for efficient service with unusual economy.

Tantalum coils reduce costs in acid plating baths

More and more plating plants are now reaping benefits from a metal that seems made to order for heating or cooling acid solutions. With Unichrome tantalum coils, they get equipment immune to all commonly used acid plating baths. The metal has high heat conductivity and resistance to thermal shock. Its corrosion resistance and hardness permit use of thin wall sections to further increase its good heat transfer.

Result: A smaller coil does a better job than bulkier coils made of other materials—and with a minimum of trouble and maintenance. This saves on replacement and loss of production during downtime. Write for literature.

UNITED CHROMIUM, INCORPORATED
100 East 42nd St., New York 17, N. Y.
Detroit 20, Mich. • Waterbury 20, Conn.
Chicago 4, Ill. • Los Angeles 13, Calif.
In Canada:
United Chromium Limited, Toronto, Ont.

Many former operating difficulties eliminated with Unichrome SRHS Solution . . . users verify various benefits

(Left): Photograph of dish drainer basket plated in ordinary chromium solution. Dark areas at base of wire fingers show no coverage of nickel.

(Right): Same product when plated in SRHS Chromium Solution. Note the even color at top and base of finger—evidence of complete coverage.

More than 700 commercial installations of the Unichrome SRHS Chromium Solution are now in operation. These have provided working demonstrations that ordinary chromium solutions, unchanged since development in 1925, are virtually obsolete.

Briefly, the striking improvements stem from several important characteristics of the SRHS bath. Namely, its higher cathode efficiencies; its self-regulation of important chemical constituents which helps maintain optimum plating balance; and its wider bright plate range. These have benefited platers in various ways. For example:

20% to 80% FASTER PLATING

With an SRHS Solution, one plater was able to speed up an automatic machine. Plating work in 2 minutes 25 seconds instead of 3 minutes 38 seconds, he not only increased the machine's capacity 33% but also improved quality by exceeding thickness specifications.

Another company needed additional tanks to handle increased production of plated cutlery. Just by using the SRHS Solution, existing capacity was stepped up and the expense of new equipment saved.

BETTER COVERAGE

Photographs above show wire baskets used in dishwashers. Ordinary chromium couldn't cover this complicated shape but the SRHS Solution plated the work completely.

The solution has wider bright plate range. SRHS Chromium, therefore, not only means less "missing" but also less "burning." Consequently, it assures fewer rejects.

MORE WORK WITH LESS CURRENT

Finishing automobile bumpers, one company could plate only 8 on a rack in the ordinary solution. Requiring less current, SRHS Chromium permitted plating 9 bumpers per rack — or an 11% increase in production with no change in equipment.

A plant plating cigarette lighters in the ordinary solution was behind schedule due to limited current. Switching to SRHS Chromium, they found it possible to plate the same work load with ⅓ less current and in ½ the time.

SELF REGULATION SIMPLIFIES PROCEDURE

A printing company installed an SRHS Solution for chromium plating rotogravure cylinders. They had no previous chromium plating experience. Despite this lack, the SRHS Bath enabled them to plate 2800 cylinders with only 5 rejects.

* * *

With results like these, it no longer pays to work with a chromium solution of the "1925 vintage." Learn how to convert your plating operation without disrupting production. Detailed technical information available. Or call in a United Chromium engineer for complete facts.

Announcing

NICKEL-

A NEW BRIGHT NICKEL PROCESS

H-VW-M takes great pleasure in presenting Nickel-Lume, a superior new bright-nickel electroplating process. Nickel-Lume addition agents are of the organic type, yet have none of the inherent faults and limitations of previous organic agents. A result of several years of careful research and development, Nickel-Lume has been subjected to stringent field tests both in job shops, with a wide variety of work and plating problems, as well as in large plant production using full-automatic equipment. In every test, Nickel-Lume has shown excellent results, a *really bright finish directly from the plating bath* with all these marked advantages:

OUTSTANDING BRIGHTNESS—full, bright deposits over a wide range of operating conditions. Relatively thin deposits, too, are *really bright;* lustre builds as thickness increases. Even intricate, deeply-recessed articles have uniform brightness without shading.

LOW INTERNAL STRESS—stress can be controlled to a low value on either the compressive or tensile side and *held* within satisfactory limits as the solution ages—no cracking, crazing, lifting, or brittleness of deposits.

HIGH DUCTILITY—comparative nickel tests show surprising ductility—even after continued bath use in production.

GOOD LEVELING—in normal deposits surface roughness is reduced 50% more. Costly polishing and buffing can be substantially reduced.

WIDE CURRENT DENSITY RANGE—without noticeable change in brightness, current density can vary from below 5 to above 70 asf. Plating speeds can change to meet various production schedules and specifications.

WIDE SOLUTION TEMPERATURE RANGE—baths may be operated at room temperature with full deposit brightness up to and beyond 140°F. With moderate to high current densities, a temperature above 120°F. is seldom required.

GOOD STABILITY—no breakdown of addition agent,

PLATEMANSHIP

PLATEMANSHIP

PLATING & POLISHING PROCESSES · EQUIPMENT · SUPPLIES

Your H-VW-M combination — of the most modern testing and developing laboratory — of over 80 years experience in every phase of plating and polishing — of a complete equipment, process and supply line for every need.

INDUSTRY'S WORKSHOP FOR THE

LUME

BY HANSON-VAN WINKLE-MUNNING COMPANY

therefore no cloudy, brittle, or highly-stressed deposits. No time-consuming, costly "stripping" operations.

HIGH TOLERANCE TO IMPURITIES—no bath "upset" by a few milligrams of metallic or organic impurities. As a rule, organics are tolerated in greater concentrations than in other bright baths.

SUPERIOR THROWING POWER—equal to or better than other commercial processes. Deposits-even in recessed areas—have uniform brightness without shading.

GOOD CORROSION PROTECTION QUALITIES—addition agent nature plus constant deposit characteristics give a high level of protection to the plated surface.

SIMPLE CONTROL—all constituents, including addition agents, can be determined and controlled by chemical analysis, thus maintaining deposits at constant and optimum characteristics.

PLEASING WHITE COLOR—approaching well-known cobalt-nickel deposits in whiteness of color—not the unappealing, yellow cast usually associated with organic addition agents.

NO OBJECTIONABLE FUMES—*ventilation is not required*—bath temperature is low, and no obnoxious or dangerous fumes are given off.

HIGH DEPOSIT ACTIVITY—deposit surfaces are exceedingly active and accept chromium or other deposits without activating treatment. In some installations, work with defective surfaces goes right back through normal plating cycle without blistering of nickel-on-nickel.

LOW INSTALLATION COSTS—all that is needed is equipment for a Watts nickel bath. Filtration can be periodic or continuous. No ventilation is required. Heat demands are low. Existing auxiliary equipment can be used.

LOW OPERATING COSTS—initial cost comparable to other bright nickel baths *but*, cost of brightener replenishment is much lower. Control is simple. No frequent pumping out and bath treatment. No production loss through sudden failure of bath to perform satisfactorily. Regular non-premium anodes are used.

Another result of *Platemanship* in action, Nickel-Lume is available NOW. Complete details and instruction manual will be forwarded on request.

HANSON-VAN WINKLE-MUNNING CO. · MATAWAN, NEW JERSEY, U.S.A. ·

HANSON-VAN WINKLE-MUNNING COMPANY, MATAWAN, NEW JERSEY
PLANTS AT: MATAWAN, N. J. • ANDERSON, INDIANA
SALES OFFICES: ANDERSON • BALTIMORE • BOSTON • CHICAGO • CLEVELAND DAYTON • DETROIT • GRAND RAPIDS • LOS ANGELES • LOUISVILLE • MATAWAN MILWAUKEE • NEW YORK • PHILADELPHIA • PITTSBURGH • ROCHESTER SPRINGFIELD (MASS.) • STRATFORD (CONN.) • UTICA • WALLINGFORD (CONN.)

H-VW-M

FINEST IN PLATING AND POLISHING PROCESSES • EQUIPMENT • SUPPLIES

"YOUR COST PER FINISHED ARTICLE IS THE *TRUE* COST OF YOUR CLEANER"

The case of the "SPOTTED BUMPERS"

Gloom had settled over the "Super's" office. Inspection was rejecting bumper after bumper because of tiny defects marring its gleaming finish.

To make matters worse—ALL the usual test methods failed to disclose the cause of the rejects.

Finally — Northwest was called. A "Cleaning Specialist" rushed to the scene. His methodical check of the cleaning and plating operations revealed nothing amiss.

Retracing his steps, the Northwest "Cleaning Specialist" found "HER". A cute blond—busily racking bumpers—with lovely hands encased in gloves held together with liberal strips of zinc oxide tape.

Here was the culprit. Her taped gloves left invisible traces of rubber-like adhesive on the parts after they had been cleaned. A new pair of gloves and production returned to normal.

This little episode illustrates our point that Northwest's "Cleaning Specialists" are not only cleaning experts in a technical sense, but practical production engineers as well.

Any one can give you a cleaning compound that will do a job of sorts, but a Northwest "Cleaning Specialist" will give you the right cleaner to keep your line running smoothly. This is the reason so many plants rely on Northwest Chemicals AND SERVICE.

Got a problem? Let our cleaning experts help you!

NORTHWEST CHEMICAL CO.

9310 ROSELAWN DETROIT 4, MICH.

pioneers in pH cleaning control *serving you since '32*

Acknowledgment

The author wishes to acknowledge the helpful assistance of Dr. E. A. Hodges of the Kocour Company; the co-operation of many of the personnel of that organization and of his own company, the King-Seeley Corporation, for their contributions to this paper.

References

[1]Howard F. Francis, J. Electrochem Soc., 95 (May, 1948).
[2]Plating and Finishing Guidebook, 20th Edition, Metal Industry Publishing Co., N. Y. (1952).

DISCUSSION

Mr. H. C. Schlaupitz (R. Wallace & Son, Wallingford, Conn.): In the figures that you presented on the board, you have compared the thickness determined by the Kocour thickness tester with microscopic thickness measurements. Your greatest differences are in the low thickness range. I think Dr. Read has determined in his research work at Penn State, and we have also found it to be the case at R. Wallace, that the microscopic method is the least reliable in those ranges. Perhaps it might be that the anodic solution method is the more accurate one and that the error given represents that of the microscopic measurement rather than that of the anodic solution measurement.

Mr. Waite: That could be true, though I know of no easy way to prove it. One of the big difficulties in that range is that any errors that may take place, which are more or less constant through a series of measurements, will have much more bearing, percentwise. That is they cause a larger per cent error in the measurement of a thin plate than in the measurement of a thick one.

There is an auxiliary unit which can be used with the Kocour unit which will allow you to measure to 0.000005 inch on coatings other than chromium and, I believe, to about 0.000001 inch on chromium.

Mr. A. W. Cagle (Western Electric Company, Winston-Salem, N. C.): Has erratic performance been experienced with the Kocour testing of tin on copper?

Mr. Waite: I have never checked tin over copper. Supposedly it can be used as such. I don't know whether Mr. Hodges is in the audience or not—I think he can answer that.

Mr. A. E. Hodges (Kocour Company, Chicago, Ill.): There should be no erratic results in testing tin over copper with the anodic solution method, providing the surface oxide film is removed. This can be accomplished by rubbing the surface lightly with a pencil eraser.

Mr. William H. Fordney (Hamilton Watch Company, Lancaster, Pa.): Are the results of microscopically made thickness measurements an average of several observations or of one point on the specimen?

Mr. Waite: By several, as I showed you by the slide—we cut a piece, ½ inch x 1 inch, out of the center at that edge. The Kocour readings, of course, were taken directly opposite. We mounted the 1 inch portion in Bakelite. We had to bend it in the middle so we took no measurements exactly at the bend, but we took the average of measurements on both sides of that throughout the entire piece.

Mr. Damon C. Antel (Westinghouse Electric Corporation, East Pittsburgh, Pa.): Has any work been done, to your knowledge, in checking the thickness of plated coatings on aluminum by this method? If so, what do you find the accuracy, and what particular coatings have been checked?

Mr. Waite: Mr. Hodges may be able to answer this better than I can. I know of no way of doing such from personal experience. I think it would be extremely difficult to find a solution in which metals ordinarily plated upon aluminum are anodically more active than the aluminum itself.

Mr. Hodges: Actually, such tests have been made, including nickel over aluminum and chromium over aluminum. We have not made any accuracy checks on the method, but the end points (voltage changes) lead us to suspect the accuracy would be very good.

Mr. Lionel Cinamon (Special Chemicals Corporation, New York, N. Y.): I notice in your column that you have a differential about 0.000010 inch consistently down the line. Does that hold true of all of the various times put in? If so, is there any reconciliation between the instrument and thickness along the 0.000010 inch line? Do you, therefore, in that manner get an instrument calibration?

Mr. Waite: I have not noticed that before, so I cannot answer your question.

Mr. Cinamon: If we assume that the instrument is correct and you have 0.000100 inch with a four minute plate, both the 20 minute plate and one hour plate become very consistent as far as accuracy is concerned. This is because if you take 15 times the four minute plate, you have about 0.00150 inch. Do the same thing on the 20 minute plate and you obtain equivalent results. It would make the instrument fantastically accurate.

Mr. Waite: The instrument is capable of extreme accuracy; it is only a question of how closely you can measure the variables. The washer that we used with the Kocour instrument, we blew up to 50 diameters and when our precision gage department drew a circle corresponding to it, we could find no error in the area from being out of round. The current must be held constant. This is probably a source of error. The density and electrochemical equivalent are exceedingly accurate, so inherently it is possible to make extremely accurate measurements with the instrument.

The reading of four minutes is done microscopically. We feel that one hundred millionths (0.000100) is about as low as it is accurate to go with the measurement of any thickness with the microscope. We feel that the error is too great if microscopic measurement

of thicknesses under 0.000100 inch is attempted.

MR. FRANCIS T. EDDY (Chase Brass & Copper Co., Waterbury, Conn.): In checking chromium on nickel, what is the reproducibility of results by the electrolytic method as compared with the hydrochloric acid spot test?

MR. WAITE: The results are very reproducible. They consistently have been less than 5 per cent. We found that the hydrochloric acid drop test gave us results closer to 10 per cent accuracy even with an experienced operator because small variations of temperature or error in timing with a stop watch can affect it materially. On the other hand, both the reproducibility and the accuracy are within 5 per cent with the anodic solution method.

MR. EDDY: Ordinarily, how long does it take to run off a test like that?

MR. WAITE: It takes about a second with the Kocour unit.

MR. EDDY: Including preparation time?

MR. WAITE: Practically none at all. It is used routinely in inspection by inexperienced operators who simply run through their operations mechanically.

MR. EDDY: Is it necessary to clamp the sample to the testing apparatus?

MR. WAITE: We do, yes. The Kocour instrument has an arrangement that makes it very easy. In the original we had the cell built right into the clamp. I have a sample of our original cell and some of the samples for you to see.

MR. EDDY: We use a ring of wax around the chromium and apply a drop of hydrochloric acid. We check the temperature very carefully and the time with a stop watch. We reproduce results within 5 per cent readily and rapidly, so that we use quality control methods all the way through on all production. There is absolutely no time lost as far as setting up the sample is concerned.

MR. WAITE: That is on chromium directly on copper?

MR. EDDY: We use the wax ring method for chromium directly on copper or brass with equally good results. What I am trying to find out is why there would be an advantage for the electrolytic method over a method as simple as the hydrochloric method.

MR. WAITE: One advantage is that you could clamp the part into the instrument, there is no time lost. It is just as fast, probably a little faster than drawing a ring of wax, measuring your temperatures and determining that everything is at the same temperature.

MR. EDDY: But if you have an irregular surface, you cannot get down into a cylindrical piece or anything similar.

MR. WAITE: We measure curves within a half-inch radius in our particular parts and have experienced no trouble. We have no parts with enough variation to cause trouble. Once we have clamped the piece in position we can measure successively first the chromium and then the nickel and copper on steel without removing the piece. It could be measured in a matter of minutes.

MR. FRANK G. BEUCKMAN (Eastman Kodak Company, Rochester, N. Y.): How do you keep the rubber washers from deteriorating with time?

MR. WAITE: We buy extra washers, they are very inexpensive, and we keep them in distilled water.

MR. BUECKMAN: How do you maintain stability of size when a clamping method is used?

MR. WAITE: It has to be done carefully. We do not use too much pressure—you get the feel of it, with experience. Our operators do it very well.

Distaff Side of the A.E.S. Convention

by Frances M. (Mrs. August R.) Hoffman

Greetings again, to all the ladies who attended the convention and to those who found it impossible to join the group. Let us settle down in a nice comfortable spot and review the happenings during the convention in Philadelphia. This will bring back very pleasant memories to those who participated in the many pleasant activities and give a bird's-eye view to those who were not able to be with us.

"Early bird catches the worm!" and what a tasty worm it was. An informal party for the Convention "early birds" was held Sunday night in the Betsy Ross room. There we met new friends and old friends with many exclamations, such as: "How nice to see you again!."

The Opening Session on Monday morning was not only interesting but also most educational. We were given a fine picture of "Tomorrow's Challenge in the Delaware." Mr. J. Harry La Brum, President of the Philadelphia Chamber of Commerce, outlined the many present developments and future plans for this vital area.

"Plating Practices in Australia" and an Australian tour were presented by our own Dr. Wm. Blum who illustrated his talk with some beautiful color slides.

Monday afternoon was indeed a delightful one. Wanamaker's auditorium was filled with ladies who came to get acquainted with neighbors from far and near. The charming Mrs. Reba Miller with her many fascinating dolls gave us many helpful points on how to tolerate and learn to live with other people.

Mrs. Miller said, "We are all Children of God."

Monday night was filled with fun and frolic. The supper dance sponsored by The Metal Finishing Suppliers' Association was an evening long to remember.

(*Continued on page 1268*)

TESTING ORGANIC FINISHES AND INTERPRETATION OF RESULTS*

C. O. HUTCHINSON†

Abstract

The author describes over sixty properties of organic finishing materials used as a basis of evaluating these coatings. He also lists standard test procedures for most of these properties, together with essential control conditions and typical values for some industrial products on which these tests are used. He presents a bibliography of valuable references on testing of organic finishes and interpretation of results. This paper should be a valuable reference to those responsible for checking the quality of organic finishes.

Introduction

Many excellent articles and books have been written about testing finishes[1–101]. Far larger, equally valuable but less available sources of information on testing organic finishes are the current finish specifications of large producers of miscellaneous painted objects. It is the purpose of this article to provide the finish specification writer, the finish test engineer, management and others with a knowledge of

(a) The important properties of organic finishes

(b) Standard published test procedures for many of these properties

(c) Typical values or test results to be expected or needed on certain objects for each test

(d) List of articles and books for background information

The amount of published information on interpretation of test results, however, is much smaller[102–114]. Great differences of opinion exist on the proper interpretation of test results. As a matter of fact, some products and some businesses succeed or fail depending on whether the finish engineer involved with a particular product uses the correct interpretation. Large amounts of finish business are transferred from one supplier to another, depending on the interpretation of test results presented to, or obtained by, the finish user.

Large numbers of books and articles also have been written on raw materials, resins, oils, pigments and solvents used in the manufacture of organic finishes and on the properties and normal uses of these materials[115–141].

Definitions

The author defines below a few terms or properties of an organic finish before attempting to test for that property or interpret the test results. With each of these definitions in Table I is given an example of an organic finished object or finish requiring a maximum amount or a minimum amount or both of this particular property. This is done to aid the reader in visualizing the importance of the particular property.

Test Methods

All the properties defined in Table I are of importance in some organic finish. A combination of five or ten of these characteristics will control or define the quality of finish used in most products because as the test requirements are increased on any one essential, sooner or later there is a decrease of some other property. Frequently, if a finish possesses several hundred per cent more of some particular attribute than currently standard products used in the industry, this product also will possess a very small per cent of some other important qualification. It is suggested that the test engineers look for tests and test procedures which determine nearly opposite properties in a finish. Table II presents in abbreviated form a list of the various test procedures, together with A.S.T.M. designations or Federal specification section numbers, where such exist, together with a few of the important controlled conditions in these tests and with typical values used by test engineers on some industrially finished products.

It will be noted that on many tests there are several standard methods for determining the particular property. In many cases there are firm differences of opinion as to which method most nearly determines the actual property involved and, more particularly, which method is most applicable to a particular finish

*Presented at the Fortieth Annual Convention of The American Electroplaters Society, June 17, 1953.
†Technical Service Director, The Glidden Company, Nubian Industrial Division, Chicago, Ill.

TABLE I. DEFINITIONS OF ORGANIC FINISHING TERMS

Abrasion Resistance
The ability to prevent wear or removal by sliding, rolling or impact of objects. Max.—Porch floors and steps.

Acid Resistance
The ability to prevent softening, loss of adhesion, loss of gloss, color change, etc., when exposed to acids. Max.—Laboratory table top finish.

Adhesion
The property that causes one substance to stick to another. There are two types of adhesion which are of interest in the case of paint. Mechanical adhesion depends on the penetration of the paint into the pores of the surface and, therefore, on the degree of penetration of the vehicle. Adhesion is also governed by the physical conditions of the surface to be coated. Min.—Machined metal parts coated with strippable coating.

Aeration Stability
Ability of the finishing material to resist chemical and physical changes when aerated. Max.—Flow coat primer.

Accelerated Weathering Resistance
The ability of the coating to withstand the action of ultra-violet light, low temperature heat, and water in much more concentrated action than normal weathering. Max.—Exterior paints.

Alkali Resistance
The ability to prevent softening, loss of adhesion, blistering, loss of gloss, discoloration when exposed to water solutions of alkaline materials. Max.—Coating for automatic washer.

Bleeding
The tendency of a material to dissolve in other coatings and cause color change. Max.—White stripping enamel for red cars (automobiles).

Blush Resistance
The ability of the finish to resist the action of condensed moisture on the surface of the film while drying. Max.—Lacquer to be used in high humidity areas.

Brushability
The ability or ease with which a material can be brushed under practical conditions. Max.—House paint.

Chalking
Chalking is a phenomenon of coatings manifested by the presence of loose powder, evolved from the film itself, at or just beneath the surface. Max.—Outdoor furniture finish.

Checking
Checking is that phenomenon manifest in coatings by slight breaks in the surface of the paint film. The break should be called a crack if underlying surface is visible. Max.—Waterproofing coating for cloth.

Cold Check Resistance
The ability of the coating system to remain intact after repeated exposure to low temperature with or without exposure to elevated temperature or ultra-violet light. Max.—Finish on wooden airplane parts.

Color
For the purposes of this article, color is defined as the optical sensation produced by the refracted, reflected and transmitted light viewed from a surface under prescribed conditions.

Consistency
Relative stiffness, body or resistance to motion or deformation of a coating composition in bulk. Min.—Solvent.

Cratering
The formation of pin holes or crater-like surface indentation in a finish.

Corrosion Resistance
The ability of the coating to prevent or retard the oxidation of metallic surfaces under prescribed conditions.

Cure
The extent of chemical reaction.

Dielectric Strength
The ability of a film to prevent the passage of electricity through the film. Max.—Coil coating for electric device.

Drying Time
The time required for an applied film of a coating to reach the desired stage of hardness or non-tackiness. There are different stages in the drying of a film, such as "dry to touch", "dry tack free", "dust free" and "dry hard". Min.—Touch-up lacquer.

Electrical Conductivity
The ability to conduct electricity. Max.—Radio circuit paint.

Elongation
The distance, measured in percentage, that a film can be stretched before it breaks. Max.—Coatings for caps and closures.

Fading
The loss of color by destruction of coloring matter through exposure to light, heat or other agents. Max.—Highway marking signs.

Filiform Corrosion Resistance
The ability to prevent worm track or mole track under film corrosion. Max.—One coat air dry enamel for metal parts.

Film Thickness
Amount of coating on surface usually measured in thousandths of an inch or mils.

Fineness
The state of sub-division of a pigment. In the paint industry it is usually determined by washing the particles through a 325 mesh screen, this residue being considered as the coarse particles. The fineness of paint pigments should be less than 0.5 per cent for most purposes.

Fire Retardance
Ability of finish to withstand decomposition or combustion when exposed to fire. Max.—Coatings for ship interiors.

TABLE I. (Continued)

Flexibility
Ability to be stretched when coated specimen is bent with coating on outside of bend. Max.—Coatings applied prior to fabrication.

Flash Point
An arbitrary ignition temperature of the saturated vapor of a thinner or solvent.

Gloss
The luster, shininess or reflecting ability of a surface, or the ability of a surface to reflect light regularly. It is based upon the degree of optical smoothness of a surface, variations in smoothness being microscopic. Min.—Coatings in optical instruments.

Grain Raising
The roughening of the surface of wood by the swelling of alternate sections of the wood, usually due to the absorption of water. Min.—NGR stain.

Grease Resistance
The ability to prevent changes in color, hardness, adhesion, gloss, etc., when exposed to liquid, solid or vaporized grease. Max.—Range finish.

Hardness
The ability of the film to resist table-top deformation or cutting from external force. Max.—Bar top finish.

Heat Resistance
The ability of the film to retain its chemical and physical properties when subjected to elevated temperature. Max.—Space heater finish.

Hiding Power
The ability of the finish to prevent the passage of light through the film.

Humidity Resistance
The ability to resist chemical and physical change such as loss of gloss, hardness or adhesion or to form blisters when subjected to high humidity. Max.—Metal parts of air conditioners and dehumidifiers.

Impact Resistance
The ability to withstand an impact or blow without cracking or loss of adhesion. Max.—Bowling pin finish.

Kauri-Butanol Value
The most popular method used in the paint industry for measuring the solvent power (solvency) of petroleum thinners. The test is based on the precipitation or clouding method. The number of milliliters of petroleum thinner required to cause cloudiness in 20 grams of the kauri-butanol solution under specified conditions is known as the "kauri-butanol value". Max.—Solvent or flow coating.

Mildew Resistance
The ability to minimize growth of microorganisms found in tropics on surface or in finish under specified conditions. Max.—Finish on fabrics used in the tropics.

Moisture Impermeability
The ability to resist the passage of moisture through the film. Max.—Coating for vapor-proof papers.

Non-Volatile Content
Amount (usually expressed in per cent) of material that does not evaporate in drying or baking. Min.—Solvent.

Odor
The volatile portion of a substance that is perceptible by the sense of smell.

Perspiration Resistance
The ability to prevent softening, loss of adhesion, blistering, gloss change, etc., when exposed to perspiration products. Max.—Jewelry coatings.

Pinholing
The formation of small holes or voids through the film.

Print Resistance
The ability to prevent surface deterioration when pressure is applied. Max.—Paper coatings.

Reflectance
The ability of the film to reflect or return the light that strikes the film. In all nonmetallic pigmented materials this also involves refraction of light. Max.—Light fixture coatings.

Sagging
The irregular flow of a film after a surface set, forming a sag or curtain.

Salt Spray Resistance
The ability to prevent deleterious effects to the film and corrosion of the base metal when exposed to salt laden and humid air.

Sandability
The ability of the finish to be cut by sanding without gumming of paper. Max.—Primer surfacer.

Suspension of Pigment
The ability of the dispersed pigment to resist settling to the bottom of the container.

Scrubability
The ability of the film to resist removal by scrubbing. Max.—Washing machine finish.

Silking
The formation of lines of color differences or surface roughness in dipped or flow coated parts. Min.—One coat dipping enamel.

Skinning
The formation of a skin or more solid-like coating over a paint or film. Objectionable in package or in film if rapid solvent release is desired. Min.—Dipping air dry enamel.

Softening
Decreasing hardness.

Solubility
The ability to be dissolved in high concentration solution.

Specific Gravity
The ratio of the weight of any volume of a substance to an equal volume of some other substance taken as the standard at stated temperatures. The usual standard for liquids and solids in water.

TABLE I. (Continued)

Stain Resistance
The ability of the film to prevent color change when exposed to surface contaminants. Max.—Table top finish.

Stability
The ability of the material to withstand the abuses incident to application and storage.

Surface Accumulation Resistance
The ability of the surface of the finish to prevent the accumulation or collection of dirt, stains, smoke, solid or liquid particles when exposed to air carrying such materials. Max.—Kitchen cabinet finish.

Surface Preparation
The condition of the surface to be finished and the method of achieving these conditions.

Tackiness
That property of a surface that makes it stick to an object touching it. Min.—Bowling alley lacquer.

Tensile Strength
The ability of a film to withstand pulling stresses. Max.—Unsupported films.

Tinting Strength
The ability to tint or change the color of another coating material. Max.—Colors used for shading.

Viscosity
A property of liquids, which may be briefly described as a resistance to flow. Min.—Solvent.

Ultra-Violet Light Resistance
The ability of the finish to withstand the deteriorating effects of ultra-violet light. Max.—Automobile finish.

Washability
The ability to withstand repeated washing without physical or chemical change. Max.—Finish for dairy equipment.

Water Resistance
Like humidity resistance, the ability to prevent change when in contact with water. Max.—Water heater tank lining.

problem. The use of common sense and the study of the action of any particular test method compared to the action on normal exposure is a good guide in deciding which procedure to use.

If one accepts the fact that test programs are run

(a) To determine the expected life of the finish on a given product;
(b) To determine the real value of two or more products or methods;
(c) To investigate possible causes of certain field failures;

then one can and must find a group of reasonably rapid reproducible specific standard tests. To the question, "What is the industry doing at the present time?", the following is listed, although differences of opinion for different standards exist:

Refrigeration

This industry, in general, runs the following tests: Application, humidity and water soak or both, stain, grease, flexibility, impact, hardness, adhesion, color stability and corrosion resistance.

Space Heaters

This industry, in general, runs application, heat resistance, color and color stability, adhesion and hardness, thermoplasticity and oil resistance tests.

Automotive

This industry, in general, runs tests on application, weather resistance, humidity or water soak, adhesion, hardness, corrosion resistance, color and color stability.

Laundry Appliance Industry

In general, this industry runs application, alkali, or detergent immersion resistance, humidity, salt spray, adhesion, bend, impact, hardness and sometimes heat resistance tests.

Television Cabinet and Wood Finishing Industry

In general, this industry runs color, gloss, application, cold check, adhesion and some stain or solvent resistance tests.

Thus, it can be seen that by taking five or ten of the properties shown in Table I, using test procedures as shown in Table II which simulate in an accelerated way the service conditions expected of the product, that the various properties can be evaluated.

"But," one asks, "how am I, as a test or specification engineer, going to decide how long a test should run?" "What should the finish stand?" One can establish this quality level by buying several brands of the particular product one proposes to make or is currently making. Each of these products or sections of these products then are tested for the various appropriate properties and observations and records of failures are made. Special programs can and have been used to predict the relative life of competitive products on the market for certain types of failure. Another system that may be used to answer produc-

TABLE II. VARIOUS TEST PROCEDURES

Property	A.S.T.M. Designation	TT–P–14lb Paragraph	Control Conditions	Products	Typical Value
Abrasion Resistance	D–968–51 D–658–44	619.1 619.2	2 l. sand/21–23 sec. till 5/32 inch failure 44g, carborundum/min; 2.5 ftair/min; till 2mm 20–30 mesh Ottawa sand till 4 mm failure CS-15 wheel: 1000 gr. weight	Refrig. Kitchen Cabinet	Max. 65 mg. CS10 wheels, 1000 cycles, 1000 gram load
Accelerated Weathering	D–822–46T E–42–42T	615.1 615.2	145° ± 5° F; 20 hr/day; 5 days/week 20 hr/day; 5 days/week; 2 hr cycles	Roof paint, various outdoor building paints	300 hrs considered equivalent to 1 year's exposure in Florida
Adhesion		MIL-L 7178	Tape test		
Alkali Resistance	D–154–50		30 g/l NaOH; 20° ± 1° C	Coating for automatic laundry eqpt.	1% detergent solution immersion at 160° F for from 100 hrs to 1000 hrs
Bleeding	D–279–31	457.1 457.2	Cellulose-base vehicle Oil-base vehicle	Striping enamels, Markings, etc.	Non-bleeding is necessary insignia characteristic of primers or undercoats over which insignia marking or striping is applied. No bleeding or discoloration is permitted after proper cure of undercoat
Blush Resistance		609.1	74–80° F; 60–70 per cent R.H.	Lacquers to be used under cond. high humidity	No blushing permitted in performance of such materials
Brushability		432.1	air dry vertically 16 hrs	House paint	
Chalking	D–659–44		dry still weathering before and during reading	Finish for outdoor furniture	
Checking	D–660–44 D–661–44			Waterprfg. and other coatings for cloth	
Cold Check Resistance				Finish for wooden airplane parts—fine furniture finish	Minimum df 10 cycles (heat and cold) reqd. for cabinet finishes by most manufacturers
Consistency	D–333–40 D–562–47		25° C; time/50 ml through A.S.T.M. cups 100 rev/27–33 sec; 25° C on Stormer		
Dielectric Strength	D–115–52T D–149			Wire coating for electric devices	See reqmts. Mil. Spec. MIL-V173-Varnish-Moisture and Fungus Resistant. For electrical equipment
Drying Time	D–115–52T D–333–40	406.1 406.2	0.0015 inch thick air dry film for varnish, lacquer, enamel 0.002 inch thick air dry film for oil-base paint		

TABLE II. (Continued)

Property	A.S.T.M. Designation	TT-P-141b Paragraph	Control Conditions	Products	Typical Value
Electrical Conductivity				Radio Circuit Paint	Test and performance of electrically conductive described in Navy Spec. 52-E-10 (ORD)
Elongation	D-552-41	453.1 622.2	Conical Mandrel 1 in/min travel, 3 inch long film 180° bend in 15–30 inch	Maximum required for coatings for caps and closures; desirable for appliance finishes, etc.	
Fading		456.1	60° C; 48 hr exposure	Highway marking signs and other identification marks for exterior use	No excessive change in value or chrome of color, and no change in hue
Filiform Corrosion Resistance				One coat enamel for metal parts, particularly air dry	
Film Thickness	D-1186-51T D-1212-52T D-1005-51	618.1 618.2	Wet thickness Dry thickness	Important that controls for governing film thickness on industrial finishes be adequately maintained	Film thickness requirements vary according to product finish; 0.8 to 1.2 mils total dry film thickness generally acceptable for two coat schedule, for most appliances. Gov. Spec. production generally specifies a definite total film thickness for each type of product
Fineness	E-11-39 D-1210-52T	441.1	Sieves Grind block		
Fire Resistance				Coatings for ships, wooden seating for public halls	Test and performance of some fire retardant coatings described in Spec. JAN-P-702, JAN-P-701, and JAN-P-697
Flexibility		622.1 622.3	0.51–0.39 in/ft panels Bend 180° over rod	While maximum flexibility is required for coatings applied prior to fabrication, a measure of this quality is necessary for all type appliance finishes	Appliance finishes may be required to stand a 180° bend over a conical mandrel without showing cracks beyond 1 inch from small end of bend
Flash Point	D-56-52 D-93-52	429.1, 429.2 429.3 429.4	Tag closed tester Pencky-Martens closed cup Cleveland open cup	Necessary information for air shipment, and may be required to comply with insurance company regulations	
Gloss	D-333-40 D-523-51	610.1 611.1	60° gloss 85° gloss		Federal Specification TT-C-595 defines tolerances Lustreless—max. 6 Semi-Gloss 30 to 50 Gloss min. of 85 per A.S.T.M. Method 610.1

TBBLE II. (Continued)

Property	A.S.T.M. Designation	TT-P-141b Paragraph	Control Conditions	Products	Typical Value
Grease Resistance				Refrigerators, cabinets and other kitchen equipment and appliances	Grease spot tests of common kitchen materials for 48 hrs at 100° F shall not soften or stain to objectionable degree
Hardness	Have none				
Heat Resistance	D–115–52T	605.1	105–110° C	Space heaters and other heating equipment	Requirements vary in degree depending on end-use. Heating appliance mfrs., etc., usually furnish standards
Hiding Power	D–344–39	411.1 411.2 412.1 413.1	Black and white checkerboard Impervious chart Dry opacity Wet opacity done after 412.1		
Humidity Resistance		620.1	90° F ± 3°; 90–100 per cent R. H.	All types of refrigerators, kitchen and laundry equipment, freezers, air cond. and sim. appliances	1000 hrs exposure without excessive corrosion required for appliance finish
Impact Resistance				Appliance finishes	Minimum rings of cracks and no loosening or flaking or other signs loss of adhesion
Kauri-Butanol Value	D–1133–50T	519.1	20 g KB solution; 25° ± 1° C		
Mildew Resistance		627.1	25–27° C; 80–85 per cent R. H.; 7 days with aspergilius Nibar	Finishes for equipment used in tropical conditions	Requirements described in such Specifications as MIL-V-173-Varnish Moisture and Fungus Resistant
Non-Volatile Content	D–333–40 D–115–52T D–154–50 D–115–52T D–268–49	 404.1 403.1, 405.1 403.1, 405.2, 405.3 404.2 404.4	100–105° C; 1 hr 132–130° C; 3 hrs, for phenolics 105–110° C; 3 hrs 100–110° C Centrifuge Supercentrifuge 125° C; 29 in. Hg; 2 hrs Water precipitation		
Odor	D–268–49	440.1		Containers for food storage or shipment	Complete absence of objectionable odor necessary for this type of product
Print Resistance	D–333–40	621.1		Paper coatings, fine furniture finishes	Cabinet finishes require no print of 1 lb wgt. in 16 hrs at 110° F—30–40 per cent R. H. on 2 hr old finish

TABLE II. (Continued)

Property	A.S.T.M. Designation	TT-P-14lb Paragraph	Control Conditions	Products	Typical Value
Reflectance	D–771–47	612.1 624.1	Daylight 45°, 0° gloss infra-red	Finishes for light fixtures, industrial wall and ceiling finishes	Typical requirement for fluorescent light fixture finish is 89–92 per cent reflectance
Salt Spray (Corrosion)	D–117–49T	606.1	20 per cent solution; *p*H 6.5–7.2; 95° F	Used as measure of corrosion inhibiting quality of finish and metal preparation for all types of production	Excellent home appliance schedule will stand 400 hr exposure with no more than ¼ inch creepage from score
Suspension of Pigment	D–869–48				
Scrubability		614.3	150 oscillations at 40 per minute	Maximum required for laundry equipment, needed for most kitchen equipment	
Silking					Complete absence of silking required for dipping finish
Skinning	D–154–50	414.1	6 oz in 8 oz can		
Specific Gravity	D–115–52T D–154–50 D–268–49	 418.1 418.2 418.3	 25° C 20° C 15.6° C vacuum Centrifuge Various methods		
Stain Resistance		608.1		Required for all kitchen and home appliances in various degrees	Commonly used kitchen material shall not soften or stain film to objectionable degree after 48 hrs at 100° F
Stability		414.2	Filled container		
Surface Preparation	D–609–52 D–358–51T	201.1 203.1 202.1 201.2 209.1	Steel-solvent deg. then-phos coat Wood Glass—no water break Tin-solvent degrease Aluminum alloy-alcoholic No. 3 Po4		Adequate surface preparation-vital to success of every finishing schedule
Tensile Strength		452.1	3 inch specimen silk pull 1 inch/min		
Tinting Strength	D–332–36 D–387–52T	422.2 422.1	Whites Colors		

TABLE II. (Continued)

Property	A.S.T.M. Designation	TT-P-141b Paragraph	Control Conditions	Products	Typical Value
Viscosity	D–115–52T		National Bureau of Stds. Method		Important that control of viscosity be set up for all industrial finishing of any volume, for maximum efficiency to be obtained with the finishing materials
	D–445		Kinematic		
	D–88	428.5	Sayhalt		
	D–1200–52T	428.2	Ford cup: 25° C		
		427.1	Gardner Holdt; 25° C		
		427.2	Falling Ball; 25° C		
		428.1	Krebs-Starmer; 25° C; 100 revs/30 secs		
		428.3	Gardner Mobilimeter; 20 cm; 25° C		
		428.4	A.S.T.M.cups–time/50 ml; 25° C		
U-V Light Resistance		456.1		Degree of such resistance required for home appliance finishes	No objectionable discoloration is permitted after 300 hrs exposure to U-V light in accepted weathering device
Washability		614.1	60 strokes/min for 70 str. for enamels and oil paints	Kitchen and laundry appliances and wall finishes, walk-in freezers, food store equipment, restaurant equipment	
		614.2	150 oscillations at 40/min for emulsion paints		
Water Resistance	D–714–45	601.1	Room temperature	Required for marine finishes, appliance finishes, water tank linings, similar to those requiring high humidity resistance	
	D–870–51T				
	D–154–50				

tion questions is through consultation with the Technical Service Departments of finishing material suppliers to obtain the background of experience and guidance on specific problems.

Example

It is always well to illustrate the suggested procedure to follow in solving a problem and the author would like to take the liberty of suggesting the following example as typical of the approach outlined in this paper.

Mr. John Smith was recently assigned by the XYZ Company, his employer, to draw up a finish specification for a new product the XYZ Company will produce in approximately six months. Others have been confronted with this problem many, many times. Mr. Smith's company is going to manufacture domestic refrigerators and his assignment is involved with the finish for the exterior of the cabinet door.

By reviewing tabulations I and II, Mr. Smith decided on the test requirements in Table III as a tentative standard.

Mr. Smith then arranged through conferences with Production Management and Purchasing to obtain panels cut from refrigerator doors and panels representative of proposed finishing materials from proposed vendors of the products. These panels then were subjected to the above tests and rated for their ability to meet these requirements and the relative resistance of the various proposed materials or actual schedules.

Mr. Smith then wrote a specification for the finishing materials after consulting with Factory Management and Purchasing so that the specified schedule was one which was in agreement with the equipment installed in the factory. The final approved specification samples were submitted by these vendors. After the completion of the tests, Mr. Smith set up one or more approved products and prepared to run repeat tests along the lines of the specification on the early production from the factory.

TABLE III. EXAMPLE OF A TENTATIVE TEST STANDARD

Properties	Comments	Properties	Comments
Abrasion Resistance	65 milligram weight less maximum	Hardness	B to 2H or perhaps 8H
Adhesion	Scratch with knife and observe	Humidity	1000 hours at 100° F
Color—White	To match standard observed visually	Impact	36 inch lbs ½ inch diameter ball
Corrosion Resistance	400 hr. test—maximum creepage ¼ inch	Non-Volatile Content	50 per cent minimum flow coat primer; 60 per cent minimum white enamel; 65 per cent minimum white primer
Film Thickness	1.8 to 2.2 mils	Stain Resistance	48 hours at 100° F
Flexibility	No crack on ¼ inch diameter mandrel	Surface Accumulation	Three months exposure to smoky atmosphere in office or laboratory
Gloss	Minimum 85 on a 65° Gloss Meter	Surface Preparation	Zinc or Iron Phosphate
Grease Resistance	48 hours at 100° F or 30 days at 70° F with no more than two pencil decrease in hardness	Viscosity	50 to 100 seconds on a No. 4 Ford Cup depending on product

Acknowledgment

The author wishes to express appreciation to Miss Aletha Kowitz for the preparation of the literature survey; Mrs. Lois Jacobs for the preparation of the many rough drafts of this paper; Mr. H. P. Wertman and Mr. L. F. Long for constructive suggestions and improvements in the text and scope of this paper, to Mr. James Andrus for encouragement and guidance in the selection of a subject and the preparation of this paper and to Mr. Jeffrey R. Stewart for permission to quote a number of definitions from his book—*National Paint Dictionary*.

LITERATURE CITED

[1]Allen L. Alexander, "Measurement of Thickness of Paint Films Applied to Non-magnetic Materials", Org. Finishing **7**, No. 1, 15–21, 63 (1946).

[2]American Society for Testing Materials, 1948, 1949, 1950 and 1951 Standards.

[3]Anon, "Exposure Tests on Paint and Varnish Films on Wood", Centraal Inst. Materiaal Onderzalk, Afdel. Verf., Circ. No. **40** (1947).

[4]Anon, "Rigidity of Paint Films", J. Oil & Colour Chemists' Assoc. **32**, 499–505 (1949).

[5]Anon, "Water Vapor Permeability of Organic Coatings", Selected Govt. Research Reports (London), Prot. and Electrodep. of Metals **3**, 140–148 (1951).

[6]W. J. Arnold, "The Measurement of Particle Size of Paints, Lacquers, and Printing Inks with the Fineness Gauge", Farbe u. Lack **58**, 103–104 (1952).

[7]Giorgio Balbi, "Practical Notes on the Determination of the Consistency of Paints", Chem. peintures **9**, 202–206 (1946).

[8]D. J. Parker, et al, "A Theoretical and Statistical Study of Sward Rocker Hardness Determinations of Paint Films", J. Oil & Colour Chem. Assoc. **34**, 160–184 (1951).

[9]Erich A. Becker, "Measurement of the Optical Properties of Paints", Arch. Tech. Messen **152**, T26 (1947).

[10]Horace A. Berman, "Nomograph for Paint Film Calculations", Anal. Chem. **19**, 913–916 (1947).

[11]Geo. Black, "Properties of Coated Panels", Org. Finishing **8**, No. 5, 33–38 (1947).

[12]Geo. Black, "The Preparation of Test Panels", Org. Finishing **7**, No. 11, 38–41 (1946).

[13]R. F. Bowles, "A Coaxial-Cylinder Viscometer of Wide Utility", J. Oil & Colour Chem. Ass. **31**, No. 333, 87–95 (1948).

[14]S. C. Britton, "An Investigation Into the Adhesion of Paint to Metal Surfaces", Sheet Metal Ind. **25**, 1185–1190, 1194 (1948).

[15]N. A. Brunt, "Testing and Physical Investigation of Paint", Verfkronick **24**, 270–272 (1951).

[16]L. Cavallero and C. Bighi, "Electrochemical Method of Evaluation of the Protective Power of Anti-Corrosive Paints and Varnishes", Peintures, pigments, vernis **26**, 141–143 (1950).

[17]Chicago Paint & Varnish Production Club, "Standardization of the Ford Viscosity Cup", Official Digest No. **298**, 831–837 (1949).

[18]Cleveland Paint & Varnish Production Club, "Weathering-Machine Correlation in the Cleveland Club and Other Areas, I", Official Digest No. **276**, 44–63 (1948).

[19]K. G. Compton, "Selection of a Protective Coating for Metals", Corrosion **4**, No. 3, 112–122 (1948).

[20]S. Conolly, "Elastic Properties of Paint Films for Metals", Metal Treatment **14**, 222–226 (1948).

[21]R. S. Dantuma, "Accelerated Weathering Tests", Verfkronick **24**, 297–301 (1951).

[22]R. S. Dantuma, "The CIMO Reflectometer as a Glossmeter", Verfkronick **24**, 293–296 (1951).

[23]P. de la Mardelle, "Control of Paints in the Automobile Industry", Congr. Tech. Intern. Ind. Peintures, inds. Assoc. **1**, 243–251 (1947).

[24]Walter H. Droste, "Testing the Weathering of Paints", Lack-u. Farben-Chem. **3**, 102–106 (1949).

[25]A. Ya. Drinberg, "Apparatus for Testing Paint and Plastic Films and Similar Materials by Accelerated Aging", U.S.S.R. 68, 415.

[26]Maynard R. Euverard, "Evaluation of Empirical Viscosity Measurements for Varnish and Resin Solutions", A.S.T.M. Bull. No. **169**.

[27]F. Faucutt and J. C. Hudson, "The Measurement of Paint Film Thickness on Mild Steel", Paint Technol. **13**, No. 146, 49–57 (1948).

[28]Federal Specification TT-P-141, Paint, Varnish & Lacquer & Related Materials, Methods of Inspection, Sampling & Testing.

[29]Earl K. Fischer and Chas. H. Lindsley, "Rheological Measurements with the Rotational Viscometer", Textile Research J. **18**, 325–337 (1948).

[30]Henry A. Gardner and G. G. Sward, "Physical and Chemical Examination of Paints, Varnishes, Lacquers and Colors", 11 Ed. 1950, Henry A. Gardner Lab.—Bethesda, Md.

[31]Werner Carmsen, "The Measurement of Thickness of Wet Films", Deut. Farben-Z. **5**, 11–14 (1951).

[32]J. A. Gascoigne, "The Testing of Paint, I, II", Ind. Finishing (London) **2**, 283–286, 288, 290–291, 359–362, 365–366 (1949).

[33]Henry Green and T. P. Lamaltina, "Measurement of Adherence of Organic Coatings to Metal Surfaces", Anal. Chem. **20**, 523–527 (1940).

[34]S. Gusman, "Testing Methods for Evaluation of Organic Coatings", Official Digest, January, 1953.

[35]H. K. Hammond and I. Nimeroff, "The Measurement of 60° Specular Gloss (of Paint)", A.S.T.M. Bull. No. **169**, 54–56 (1950).

[36]V. G. W. Harrison, "Gloss Measurement", Paint Manuf. **20**, 277–279, 293 (1950).

[37]W. T. Harvey, "Calibration of Gardner-Holt Air-Bubble Viscometers of the Regular Varnish and Heavy-Bodies Series", Official Digest No. **274**, 616–618 (1947).

[38]Manfred Hess, "Paint Defects", Chapman & Hall—London.

[39]J. Hockstra and J. A. W. Van Laar, "Indentation Meter for Paint", Paint, Oil and Chem. Review **115**, No. 18, 16–18, 20–22 (1952).

[40]J. Hockstra, "Determination of the Hardness of Paint Layers", Verfronick **25**, 13–17 (1952).

[45]H. A. Holden, "Chemical Treatments for Zinc Surfaces—A Review", Sheet Metal Ind. **24**, 1975–1983 (1947).
[46]G. W. Houston, et al, "Testing of Drying Oils. II. Evaluation of Natural and Synthetic Oils", J. Am. Oil Chem. Soc. **26**, 244–249 (1949).
[47]F. Hudswell, "The Adhesion and Stability of Films", Ministry of Supply, Harwell, Berks. (Engl.) At. Energy Res. Estab., Unclassified C/R **861**, 3–9 (1952).
[48]Walter Heyne, "Evaluation of the Hardness of Coatings Through Damping of Oscillations", Farbe-u-Lack **58**, 58–63 (1952).
[49]Yukihiko Inoune, "Brittleness of Coatings—Cellulose Lacquers", J. Chem. Soc. Japan, Ind. Chem. Sect. **53**, 71–72 (1950).
[50]Keuringsmethoden, Commissie, Verf., "Hiding Power of White Paint Films", Centraal, Inst. Materiaal Onderzack, Afdel. Verf., Circ. No. 11 (1945).
[51]Roy H. Kieule, "Physical Chemical Research in the Protective Coatings Industry", Official Digest No. **300**, 11–52 (1950).
[52]W. W. Kittelberger and A. C. Elm, "Diffusion of NaCl Through Various Paint Systems", Ind. Eng. Chem. **44**, 326–329 (1952).
[53]H. Krause, "Porosity Testing of Metallic and Non-Metallic Protective Coatings", Metalloberflache **2**, 17–18 (1948).
[54]Max Kronstein, "New Standard for Coating Thickness", Chem. Eng. **59**, No. 6, 201–203 (1952).
[55]B. M. Letsky, "Adhesion and Application of Organic Coatings to Metal", Paint Manuf. **19**, 425–426, 434 (1949).
[56]E. W. J. Mardles, "Viscosity of Paints and Suspensions," Selected Govt. Res. Repts. (London), Paints **2**, 5–22 (1949).
[57]Charles J. Marsel, "Study of Some Methods of Measuring Adhesion of Paint Films", N. Y. Univ. Coll. Eng., Symp. on Varnish and Paint Chem., 1948, 61–70.
[58]H. Meincke, "Abrasion Testing of Coating Films", Farbe-u-Lack **57**, 97–100 (1951).
[59]Otto Merz, "Test Equipment for Coatings", Farben, Lacke, Austrickstoffe **3**, 425–431 (1949).
[60]Otto Merz, "Methods for Testing and Examination of Coating Materials", Farben, Lacke, Austrickstoffe **4**, 5–14 (1950).
[61]Otto Merz, "Testing and Laboratory Equipment", Farbe-u-Lack. **57**, 136–138 (1951).
[62]H. C. Miller and I. C. Clare, "Cold-check Resistance of Nitrocellulose Lacquers", Paint, Oil, Chem. Rev. **112**, No. 19, 12–14, 37–38, 40, 42–44 (1949).
[63]Saul Moses and R. K. Witt, "Evaluation of Adhesion by Ultrasonic Vibrations", Ind. Eng. Chem. **41**, 2334–2338 (1949).
[64]National, Paint, Varnish & Lacquer Assn. Special Circular, August, 1951, "Control Testing Methods for Wood Finishes".
[65]L. M. Nevyazhskaya, "Testing of Model Lacquers", Zavodskaya Lab. **16**, 368–369 (1950).
[66]New England Paint and Varnish Production Club, "The Standardization of Methods of Measuring Viscosities of Nitrocellulose Lacquers", Official Digest No. 286, 835 (1948).
[67]New England Paint and Varnish Production Club, "Standardization of Methods of Measuring Viscosities of Nitrocellulose Lacquers", Official Digest No. 298, 735–743 (1949).
[68]H. A. Newnham, "Design of a Paint Test Procedure", Paint, Oil Colour J. **117**, 575–578 (1950).
[69]N. Y. Paint & Varnish Production Club, "Study of the Dielectric Strength of Paint, Varnish and Lacquer Films", Official Digest No. 276, 9–28 (1948).
[70]L. S. Palatnik, "X-ray Method for Determining the Thickness of Coatings by a Superposition Method", Zavodskaya Lab. **15**, 1043–1054 (1949).
[71]B. Persoz and Mme. G. Grenier, "Surface Adhesivity", Peintures, pigments, vernis **23**, 360–364 (1947).
[72]B. Persoz and Mme. G. Grenier, "Calibration of L.C.H. Viscosity Cups", Peintures, pigments, vernis **24**, 23–24 (1948).
[73]R. J. Phair, "Testing Techniques and Uses of Equipment for Evaluating Organic Coatings", Paint and Varnish Production **30**, No. 6, 8–11, No. 7, 12–15, 17–19 (1950).
[74]Philadelphia Paint & Varnish Production Club, "Method of Test (Laboratory)", Official Digest No. 276, 96–102 (1948).
[75]John G. Piceu, "Gravelometer Tests—Coated Panels", Ind. Finishing **24**, No. 9, 110, 112 (1948).
[76]I. R. Quarendon, "Paint Viscosity Meters", Official Digest No. 308, 645–648 (1950).
[77]H. Rabaté, "Results of Laboratory Test Methods. Durability of Paint, Varnish, and Similar Preparation", Peintures, pigments, vernis **27**, 417–424 (1951).
[78]A. W. Rick, "Porosity Testing of Lacquer Films", Farbe-u-Lack.
[79]J. R. Rischbieth, et al, "A Modified Nomograph for the Evaluation of Paint Exposure Panels", Australia, Dept. Sup. and Dev., Paint Notes **4**, No. 2, 34–41 (1949).
[80]H. Roesler, "Porosity Tests for Coatings", Farbe-u-Lack. **55**, 42–46 (1949).
[81]Clifford J. Rolle and Theresa L. Dietrich, "Evaluation of Paint Films. The Interchemical Adhereometer", Anal. Chem. **21**, 996–997 (1949).
[82]F. C. Schmutz and J. M. Gallagher, "A Method for the Routine Determination of Dry Hiding Power of White Paints", A.S.T.M. Bull. No. **153**, 77–81 (1948).
[83]W. K. Schneider, "Electrochemical Evaluation of Organic Coatings for Food Container Closures", Food Technol. **3**, 192–195 (1949).
[84]W. E. Shaw and D. L. Hawke, "Electrical Measurements on Metal Protective Paints", Org. Finishing **10**, No. 10, 19–22 (1949).
[85]W. E. Shaw and D. L. Hawke, "Electrical Measurements on Metal Protective Paints", Can. Paint & Varnish Mag. **23**, No. 6, 18, 20, 22, 40, 42 (1949).
[86]O. J. Sieplein, "Paint Testing in South Florida", Official Digest No. 303, 309–314 (1950).
[87]W. T. Smith, "Postwar Wood Finishing. II. Suggested Method for Predicting Check Resistance of Lacquer Films", Trans. Am. Soc. Mech. Engrs. **72**, 167–173 (1950).
[88]G. H. Spencer Strong, "Evaluation of Competitive Finishes", J. Am. Ceram. Soc. **33**, No. 10.
[89]D. E. Star, "Special Performance Testing of Paints", Paint Manuf. **16**, 425–430 (1946); **17**, 24–25 (1947).
[90]M. H. Switzer, "A Suggested Method of Test for Hiding Power of Paints", Am. Paint J. **35**, No. 51, 64, 66, 68–69, 72, 74 (1951).
[91]H. W. Talen and T. Hoog, "Determination of the Fineness of Grinding of Paints with the Help of the Fineness Meter", Verfkronick **22**, 209–210 (1949).
[92]H. W. Talen, "Determination of the Flexibility of Paint Films on Their Base", Verfkronick **13**, 15–18 (1950).
[93]H. W. Talen and N. A. Brunt, "Testing the Resistance to Wear of Paints", Verfkronick **23**, 236–238 (1950).
[94]Kenneth Tator, "Cuts Paint Evaluation Time", Chem. Eng. **58**, No. 10, 140–142 (1951).
[95]Morris A. Thomas, "Moisture Permeability, Diffusion, and Sorption in Organic Film Forming Materials", J. Applied Chem. (London) **1**, 141–158 (1951).
[96]H. Van der Veen, "Corrosion and Paint Failure, A Review of Foreign Literature 1/1/40 to 7/1/45", Centraal Inst. Materiaal Onderzolk Afdel Verf. Circ. No. **12**, 1945.
[97]Kenji Weki and Michio Yumoto, "Investigation of the Mechanical Properties of Cellulose Lacquer", J. Soc. Textile Cellulose Ind. Japan **3**, 114–117 (1947).
[98]J. van Loon, "Rapid Examination of the Rust Preventing Properties of Paints", Verfkronick **21**, 182–185 (1948).
[99]R. H. Warring, "Brittle Lacquers—The Use of Paint for Shear Testing", Ind. Finishing (London) **4**, 133–134, 137–138, 140 (1951).
[100]K. Wekua and B. Hoffmann, "Method for the Determination of Porosity in Coating Films", Farbe-u-Lack. **58**, 250–254 (1952).
[101]Mark W. Westgate, "The Flame Spread Resistance of Paint Films as Tested by the Inclined Panel Method", Natl. Pt., Varn., Lacq. Assn., Sci. Sect. Circ. No. 747, 460–473 (1951).
[102]S. V. Yakubovich and T. I. Vorogushin, "Apparatus for Testing Lacquer Paint Coatings at Low Temperature", Zavodskaya Lab. **14**, 506–508 (1948).
[103]S. V. Yakubovich and T. I. Vorogushin, "Method of Testing the Strength of Lacquer Coatings Against Impact Stretch", Zavodskaya Lab. **15**, 594–599 (1949).
[104]S. V. Yakubovich and T. I. Vorogushin, "Evaluation of Destruction of Paint and Lacquer Coatings and of Their Performance Stability", Zavodskaya Lab. **16**, 823–833 (1950).
[105]G. Zeidler and H. Roesler, "Hardness Tests of Paint and Varnish Films", Farbe-u-Lack. **54**, 94–98 (1948).
[106]R. S. Dantuma, "Wear Tests on Lacquers and Paints", Verfkronick **16**, 36, 7, 43–48, 56–57 (1943).
[107]R. S. Dantuma, "Measurement of the Layer Thickness of Coatings", Verfkronick **17**, 57–62 (1944).
[108]A. J. Eickhoff and W. E. Shaw, "Principles of Protecting Metals with Organic Coatings", Corrosion **4**, 463–475 (1948).
[109]A. C. Elm, "Testing Durability of House Paint Systems for Outdoor Use", Paint, Oil, Chem. Rev. **112**, No. 10, 16, 18, 43–44, 46 (1949).
[110]R. W. Hill and G. S. Cook, "Suggested Modification for Determining Shear Hardness with the Taber Abraser", Official Digest No. 279, 339–342 (1948).
[111]H. Hollis, "Performance Testing of Paints, with Particular Reference to Tests Which Have a Bearing on Ultimte Outdoor Durability", J. Oil & Colour Chem. Ass. **30**, No. 329, 431–456 (1947).
[112]Richard S. Hunter, "Gloss Measurement of Paint Finishes", A.S.T.M. Bull. No. 150, 72–77 (1948).
[113]Sigurd Kohler and Kurt Laurell, "The Vila Method for Rapid Testing of Antirust Paints on Steel. Comparison of Salt-Water Spray and Tropical Chamber Tests", Iva **19**, 234–248 (1948).
[114]C. A. Lominska, "The Philosophy of Paint Exposure Test-

ing", Paint, Oil & Chem. Rev. **115**, No. 14, 24–26, 28–32 (1950).
[111]P. G. Meerman, "Physical Testing Methods (For Paint and Paint Materials)", Centraal Inst. Materiaal Onderzalk Afdel. Verf. Circ. No. **15** (1945).
[112]W. T. Moran and G. E. Burnett, "Laboratory Tests of Protective Coatings Versus Service Results", A.S.T.M. Bull. No. 165, 73–80 (1950).
[113]R. Quarendon, "Methods of Testing Adhesion of Paints", Paint Manuf. **20**, 427–433 (1950).
[114]R. Quarendon, "Paint Coating Thickness Meters", Paint Manuf. **21**, 357–362 (1951).
[115]Frederick W. Bogart, "Enamel Linings for Metal Containers", Org. Finishing **8**, No. 12, 39–45 (1948).
[116]Charles O. Burgess, "Which Coating for Gray Iron", Product Eng. **21**, No. 10, 103–110 (1950).
[117]P. A. Cartwright, "Metal Finishing Handbook", Blackie & Son—London.
[118]H. W. Chatfield, "Glossary of Terms Used in the Paint, Varnish & Lacquer & Allied Trades", Scott, Greenwood & Son—London.
[119]K. G. Compton, "Selection of Protective Coatings", Can. Chem. Process Ind. **32**, 1027–1030, 1033 (1947).
[120]K. G. Compton, "Building Organic Protective Coatings to Special Requirements", Corrosion **5**, No. 5, 148–150 (1949).
[121]Wilfred F. Coxon, "Modern Development in Metal Finishing", Arrow Press—Leighton Buzzard, Beds.
[122]Wilfred F. Coxon, "Industrial Finishing Yearbook 1951 Ed., Arrow Press—Watford, Harts.
[123]William V. Fischer, "Paint and Varnish Technology", 1948, Reinhold Pub. Co.—NYC.
[124]J. W. Gailer and E. J. Vaughan, "Protective Coatings for Metals", Charles Griffin & Co.—London, 1950.
[125]J. A. Gascoigne, "The Choice of Paint—II. Paint in Action", Ind. Finishing (London) **1**, 540, 542–544 (1949).
[126]J. A. Gascoigne, "The Choice of Paint—Essential Constituents", Ind. Finishing (London) **1**, 484–486, 488 (1949).
[127]J. A. Gascoigne, "The Choice of Paint—III. Surface Coatings Today", Ind. Finishing (London) **1**, 709–712, 714 (1949).
[128]J. A. Gascoigne, "The Choice of Paint—IV. 20th Century Varnishes—V. Speed and Color", Ind. Finishing (London) **2**, No. 14, 56, 58–64, 121–124, 126–128 (1949).
[129]G. B. Heckel, "The New Paint, Varnish & Lacquer Catechism", Heckel Pub. Co.
[130]J. C. Hudson and T. A. Banfield, "Protection of Steel by Various Non-Metallic Coatings", J. Iron Steel Inst. (London) **158**, 99–100 (1948).
[131]Otto Merz, "Tasks and Problems in the Coating Industry", Farben, Lacke, Austrichstaff **3**, 2–9 (1949).
[132]Metal Finishing Guidebook and Directory, 19 Ed. 1950, Finishing Pubs.—N.Y.C.
[133]W. A. Raymond, "Metal Finishing Guidebook and Directory", Finishing Pubs.—N.Y.C.
[134]J. S. Remington, "Drying Oils, Thinners & Varnishes", Abacus, London.
[135]C. W. Reynolds, "Modern Scientific Instruments and Apparatus Used in Testing New Developments in Dry Colors", Can. Paint & Varnish Mag. **24**, No. 2, No. 4, No. 5, No. 7, No. 8 (1950).
[136]W. J. Roberts, "Finishing Handbook and Directory", Sawell Pubs.—London.
[137]Francis Scofield, "Resin Index of 1950", Nat. Pt. Varn. Lacq. Assn., Sci. Sect., Circ. No. 738 (1950).
[138]G. W. Seagren, "Organic Coating for Corrosion Protection; A General Discussion", Corrosion **4**, No. 5, 219–226 (1948).
[139]Walter A. Sperry, "Paints and Protective Coatings", Sewage Works J. **20**, 319–323 (1948).
[140]J. R. Stewart, et al, "National Paint Directory—3rd Edition", Stewart Res. Lab., Washington, D. C.
[141]S. P. Wilson, "Finishing Materials 1923–1948", Ind. Finishing **25**, No. 1, 58–60, 62 (1948).

DISCUSSION

MR. HOWARD E. SCHEARER (Keystone Lamp Manufacturing Company, Slatington, Pa.): Do you have any list of test methods for sulfite resistance of clear organic coatings?

MR. HUTCHINSON: I don't know of any published standard test procedure, but I have had some experience in trying to evaluate coatings for that purpose and realize that you have a rough problem. If you can do so, I would suggest that you use various concentrations in water, using an immersion test or spot test. At least our experience of attempting to put sulfide into the air and still getting a controllable test was certainly very negative.

MR. H. A. FUDEMAN (Trico Products Corporation, Buffalo, N. Y.): You indicated in your charts a knife test for adhesion testing. Certain other literature and tests I have seen indicated a finger nail test. Could you give me your concept of both these tests?

MR. HUTCHINSON: The finger nail test is usable for relatively soft coatings such as air dried finishes, lacquers or decorative coatings that you would put on with a brush. But baked-on industrial finishes such as those used on appliances are of such excellent adhesion that there are very few finger nails that are strong enough to remove them.

MR. CINAMON (Special Chemicals Corp., New York, N. Y.): Are there any specifications with regard to methods of preparing samples, especially those with extremely low viscosity which have a film thickness of about 0.0002 inch? How are those films prepared?

MR. HUTCHINSON: Normally, when we attempt to apply low viscosity coatings at low film thicknesses, we use dipping, if the viscosity is high enough to produce the desired film thickness. If not, there are two other possibilities: (1) an experienced spray man can often put on a coating that will be uniform (to perhaps half a mil, giving the film thickness you mention); (2) there are also some machines on the market for spray applying coatings to test panels, that maintain a controlled distance from the spray gun to the panel and a controlled speed at which the gun passes the panel. These are quite useable for laboratory purposes.

MR. CINAMON: Then I understand you to say that the only method you have found of practical use is the spray method and that no other mechanical methods will do.

MR. HUTCHINSON: You can dip them. There is another method involving putting material on a panel in a horizontal position and rotating it at some specified speed, so that you will drive all the excess paint off the surface.

MR. CINAMON: Supposing you had a mixture containing aluminum pigment or flake aluminum. It will not behave the way you would like to have it behave. Naturally it won't flake out as uniformly as the coating itself. What do you do in a case of this kind to get uniform coating?

MR. HUTCHINSON: How was the film applied in production?

MR. CINAMON: Sprayed in production, but when you apply a salt spray test, the panels must be uniform. The automobile industry uses some method that does not seem to correlate with the methods used

in the East and I have not been able to find a standard method of application. Do you know of any?

MR. HUTCHINSON: No, but my opinion is that any panel being prepared for test purposes should have the finish applied by something approaching the standard production method because the end results are in part a function of the method of application. Flow coat or dip applied coatings produce much more continuous, much more uniform film thicknesses than spray applied coatings.

It would be my opinion that if the aluminum coating you are referring to is sprayed, or is spray applied in production, upon the parts, then the test panels should be spray applied.

MR. R. F. HAFER (Reynolds Metals Company, Louisville, Ky.): What method of testing would be proper to test for a scuffing tendency of bronze-type lacquer or other semi-bright pigmented coatings?

MR. HUTCHINSON: A scuffing tendency—a tendency to reduce luster or to produce marks on the surface of the film?

MR. HAFER: Yes, to produce noticeable rub marks that tend to detract from the semi-bright pigmented finishes such as the bronze.

MR. HUTCHINSON: There are several methods that might be used. One would be a surface hardness test of the material. Another would be the Taber abraser with a low weight load and a small number of revolutions to give a measure of the ease of wearing off of the top surface. Many people with experience in coatings of that nature use a test that is performed something like this . . . (using back of fingernails) . . . simply drawing lines over the surface of the film, but that is not very standard because we have as yet to find a standard fingernail.

MR. ISIDORE CROSS (Harper-Leader, Inc., Waterbury, Conn.): Many people use Scotch Tape as a criteria for adhesion. What is your opinion of the value of that test?

MR. HUTCHINSON: If the adhesion or the adhesive strength of the tape is specified, and if the method of removing the tape from the paint film is specified, it is a pretty good procedure. It is used at the present time on many ordnance ammunition items as a measure of adhesion of the organic coating to projectiles, for instance. Most of you, if you have tried it, will find that a paint coating that can be removed from a surface with Scotch Tape certainly has very poor adhesion.

It is also used in salt spray testing, to remove the loosened paint around the score to give you a measure of the area over which adhesion has been lost during the test program. It helps you remove film where there is no rust visible under the film. I think it is a valuable aid in paint testing. We use it extensively.

MR. EDWARD B. WASHBURN (McKinney Mfg. Company, Pittsburgh, Pa.): What type of testing procedure would you advise for highly buffed, solid brass articles which are going to be subjected to outside exposure?

MR. HUTCHINSON: Is there any organic finish applied over the highly polished brass?

MR. WASHBURN: We have tried about 100 of them.

MR. HUTCHINSON: I am not sure that I can answer your question other than, perhaps, to give a list or a group of test procedures that would be applicable in evaluating organic coatings.

MR. WASHBURN (handing Mr. Hutchinson a sample): Would this help you?

MR. HUTCHINSON: Of course, there are several things you can do. One would be to use a humidity test; another is the use of a salt spray test. There is a lot of difference of opinion on this test but my opinion is that it is a valuable one. Another device to use would be the accelerated weather testing machine, which involves a water spray and ultra-violet lamp—because some of your failures may be due to decomposition of the film in the presence of ultra-violet light.

Another of your problems may be that of obtaining adequate film thickness on the sharp edges. Perhaps you would want to do some exploring with two electrodes to see if your coating is continuous.

There probably are other steps to take. However, those given are a starting point, certainly.

MR. WASHBURN: Where do you find material to meet the specifications?

MR. HUTCHINSON: There is needed a commercial reflection to answer that question. We are currently supplying such finishes on the West Coast.

MR. HERMAN A. TESSMANN (Allen-Bradley Company, Milwaukee, Wis.): What is a good time interval between application and testing of synthetic enamels?

MR. HUTCHINSON: That depends on the material. If it is a baked material that converts primarily in the baking operation and does not undergo oxidation or much additional polymerization with age, then a few days' time interval is satisfactory.

If it is a material such as a lacquer finish on radio or television cabinets, you must age it at least seven days to get all the solvent out of the film. If it is an air-dry coating such as house paint that dries primarily by oxidation, I don't know how to really substitute for time—I don't have any answer.

MR. TESSMANN: This is an alkyd-urea resin based baking enamel.

MR. HUTCHINSON: Normally, from one to three days' aging is satisfactory, but the coatings definitely should be aged after coming out of the oven.

MR. EDDY (Chase Brass & Copper Company, Waterbury, Conn.): What do you have to recommend as to perspiration resistance tests?

MR. HUTCHINSON: Recently there was an ad in one of the trade papers—I don't remember which one—for a synthetic perspiration which can be purchased by the gallon for immersion tests. If you will give me your name, I will be glad to look into the literature and see if I can find that reference.

MR. EDDY: Are you talking about the common salt, acetic acid, butyric acid, valeric acid mixture?

MR. HUTCHINSON: I presume so.

MR. EDDY: That is not too satisfactory, because we have run thousands of tests. All types of people have different perspiration characteristics, as you can probably imagine, and the best method we found was to find some person in the plant such as a secretary; we would give them samples, such as a lipstick container and have them carry the sample around for three to four months. This is a little bit long to determine what type of materials you should use.

MR. HUTCHINSON: We ran tests similar to that at one time by attaching small panels to a leather belt that was put around the waist of a fireman in our boiler room and he had a perspiration system that seemed to break down most organic coatings after a day or two. We did get a reasonably valuable evaluation of materials, but you must run some form of standard each time you run the tests. I don't know any really good way of reproducing perspiration resistance in an accelerated way.

MR. EDDY: That is exactly what we found—your fireman is comparable to a watchman that we have—he can take a material off in 48 hours that will last for years in normal use.

Distaff Side

(Continued from page 1254)

The music, together with the delicious supper, topped with cool drinks, molded each attendant in spirit of fun which ended in a gala evening for all.

Tuesday morning brought the ladies together to participate in the usual very super Aunt Ella party sponsored by the Oakite Products, Inc. We left by bus for Drexelbrook Inn, where a tasty luncheon was served. Mr. Dave Clarin again took over the delightful affair. He remembered to bring back from his trip some interesting gifts which he presented to two lucky ladies. It was that very day, very hour, and very minute, when every lady wanted to possess a slender figure, size 14, so that the colorful hand made jacket would fit her. Anyway, we all declared that we had fun just entertaining the moment of anticipation!

Immediately after lunch, we went to Longwood Gardens where we were literally transported to a garden of magic beauty.

Wednesday was exactly what "the doctor ordered." The steamer, *Delaware Belle*, took us out on the cool shining water of the Delaware River. We feasted on wholesome delicacies as the whispering echoes of the waves reached the deck. This was followed by our delightful and most profitable Plato Party sponsored by I.F.C. with Mrs. Joan Wiarda as our gracious and considerate hostess.

Thursday morning brought again the Ladies' Educational Session which was first introduced in Boston in 1950. Do you remember? Since then, not only do the ladies look forward to the social events of the week, but also to the Educational Session in which they seek "solid" information about plating terms and plating secrets. This, we remember was launched with a delicious breakfast sponsored by Lea Manufacturing Company with Mr. R. Crane as our official quizzer. Groucho Marx would have declared the session very amusing.

The ladies again remarked "It should have lasted longer and Mr. Crane should have given us more plating points." This was a good indication that the wives continue to "yearn to learn," not only about plating, but also about their husbands' activities.

Then after the Educational Session, we had a special sight-seeing trip through many of the historic places of Philadelphia. The good ladies who served on the various convention committees were suddenly transformed from housewives into efficient guides. Congratulations!

Thursday night again brought the event which we look forward to each year with much enthusiasm and joy. It is the night when we not only have fun but also everyone brings much charm. It was truly a gala affair with jolly people and an event which had color and lasting memories. The floor show was superb, the meals delicious and prizes galore!

Thus again, ended the well organized, very ably executed convention which took place in the historic city of Philadelphia and which we again declare, the best convention in 1953.

I am sure that I voice what every lady who attended the convention would like to express sincerely: We felt that our charming chairman, Mrs. Delmar Robson and her very able committee radiated a feeling of welcome. They demonstrated patience and courtesy at all times. In every instance, they were anxious to be of assistance to all of us. It is also amazing to all of us to find such a fine group of capable women who executed the Ladies Program. We fully realize and appreciate the untiring efforts which were woven into this very successful project.

In behalf of all the ladies who attended the convention, may I extend to Mrs. Robson and her committee a most grateful "thank you," and may it be resolved that their graciousness, hospitality and efforts be remembered as part of the 40th Annual Convention which was organized and executed so efficiently and so pleasantly.

Each year we write in our diary that the Convention was best in that year. Please accept our sincerity. Philadelphia ladies did a beautiful job. We are looking forward to New York City next year. We have already met the Chairman. She is charming! We know, "all is well", and that the New York Convention will be the best in 1954.

project no. 12

project director:
HENRY B. LINFORD*

associate:
EDW. B. SAUBESTRE*†

location:
COLUMBIA
UNIVERSITY,
NEW YORK CITY

Acknowledgment is due the Research Committee, Dr. W. A. Wesley, The International Nickel Company, Chairman; the Research Directing Committee, Mr. G. M. Cole, Ternstedt Division, General Motors Corporation, and Dr. Donald Price, Oakite Products, Inc., Chairman and Vice-Chairman, respectively; and the Project Committee, Mr. E. T. Candee, Lea Manufacturing Company, Chairman; Dr. W. A. LaLande, Jr., Pennsylvania Salt Manufacturing Company, and Dr. Edward Parker, Technic, Inc., for their contributions to this project.

* AUTHORS
† Presently with Sylvania Electric Products, Inc., Flushing, N. Y.

CLEANING AND PREPARATION OF METALS FOR ELECTROPLATING

VII. FINAL SUMMARY ON DEGREASING EVALUATION TESTS

Purpose

The purpose of Project 12 has been to study the cleaning and preparation of metals for electroplating. As was pointed out in the critical review of the literature[1a,b,c] the causes of plating failure may be subdivided into several categories. It was decided to study first residues of oils, fats, and waxes. In commercial preplating operations, these materials are generally removed in two steps: (a) solvent treatment to remove the bulk of the grease and (b) alkaline cleaner treatment, either soak or electrolytic, to remove the final traces of these substances. Many adequate commercial processes exist for removing such oily material, and a satisfactory amount of research work is continuing in this field. Knowledge of testing procedures, however, has not kept pace. Therefore, the work in this project has been directed at the development and evaluation of testing procedures, rather than at the development and evaluation of cleaning processes.

Such tests must be designed to serve two groups: (a) those who wish to develop and evaluate new cleaner products, and (b) those who wish to evaluate the current condition of an industrially acceptable cleaning bath after a period of use. Considering the first group, the test should be sensitive and quantitative. Most modern commercial cleaners are capable of removing readily the bulk of the oil which may be present on any piece of work. Therefore, in order to establish differences between two formulations, the test must be very sensitive in order to register these differences, and must be capable of quantitative interpretation in order to make a proper economical balance between them. Considering the second group, a stop-or-go type of test is required (i. e., either the commercial bath is still usable or is no longer usable and must be replaced). This test should be very sensitive and reliable (good reproducibility between different test runs). In view of the fact that the plating industry consists, in large measure, of small shops, a desirable test should also be inexpensive to set up and operate, and should be capable of operation by personnel with little technical training.

A New Test—The Atomizer Test

The authors, keeping these requirements in mind, have developed a new test, called the "Atomizer Test". They feel that the characteristics of this test are such that it should prove to be superior to existing tests both for those who are developing or evaluating new cleaner compositions and those who desire a good industrial control test for existing cleaners. The details of this test were presented orally by the senior author at the 1951 A. E. S. convention[1d]. In essence, this test, like the prevalent water-break test, depends upon the fact that the presence of oil on a metal surface decreases its wettability by water. For two major reasons (discussed previously[1d,f]), it is distinctly more sensitive than the water-break test. These reasons are related to

TABLE I. EFFECT OF OIL DISTRIBUTION ON SENSITIVITY OF DEGREASING EVALUATION TESTS

(Relative Values for Matte Surfaces)

Oil	Lard Oil		Mineral Oil	
Distribution	Uniform Films	Discreet Globules	Uniform Films	Discreet Globules
References	2	1	2	1
Atomizer	1.0	1.0	1.0	1.0
Water-break (Spray-Pattern)	10.0	160	30	165
Fluorescent Dye	400	5.7	130	25
Potassium Ferricyanide	450	220	330	620
Copper Sulfate dip	480	870	—	350

[1] H. B. Linford, and E. B. Saubestre, Plating **38**, 1263-66 (1951).

[2] Ibid., **40**, 489-96 (1953).

hysteresis of the contact angle and "bridging" of globular oil residues. The atomizer test is anywhere from 10 times more sensitive than water-break with uniform oil deposits such as those remaining after solvent treatment[10a,k] to 160 times more sensitive with oil residues remaining after alkaline cleaning[10a,b].

Sensitivity of Degreasing Evaluation Tests

In order to assess more fully the value of the atomizer test, the authors investigated all of the previously developed commercial degreasing evaluation tests[10g-i,k]. In some cases, additional development work was required to render them capable of quantitative interpretation. It was recognized that the sensitivity of a degreasing evaluation test will depend upon many variables. The major variables that were considered in this work are: (a) type of oil, (b) oil distribution and (c) surface preparation. With regard to type of oil, the tests were found generally more sensitive to non-spreading oils (fatty acids, for example) and partially spreading oils (fatty oils, medium oils)

TABLE II. SENSITIVITY OF DECREASING EUALUATION TESTS*

Type of Contamination		Fatty Acids		Fatty Esters			Medium Oils			Paraffinic Oils		Average
Oil		Stearic Acid	Oleic, Stearic Acids	Tristearin, Lard Oil		Tripalmitin; Olive Oil	SAE 60 Motor Oil	SAE 50 Motor Oil Min.-Lard Cutting Oil	Lubricating Oil	Mineral Oil; SAE 10 Motor Oil; 101 Cutting Oil		
Reference		3	4	4		1	2	4	5	4		
Surface Finish		Polished	Matte	Matte	Polished	Polished	?	Matte	?	Matte	Polished	
Test Type	Name											
Wetting	Water-break (Spray-pattern)	$<2\times10^{-7}$	1.5×10^{-7}	5×10^{-7}	3×10^{-7}	.....	1×10^{-6}	1.5×10^{-6}	.....	9×10^{-6}	1.5×10^{-6}	1×10^{-6}
	Atomizer	.....	2×10^{-6}	6×10^{-6}	3×10^{-6}	3×10^{-6}	.....	1×10^{-7}	.....	4×10^{-7}	1×10^{-7}	8×10^{-6}
Tracer	Fluorescent Dye†	.....	.....	3×10^{-5} (1.5×10^{-7})		.....	1×10^{-5} (2×10^{-7})	.....	4×10^{-6} (‡)	4×10^{-5} (2×10^{-7})		1×10^{-5} (2×10^{-7})
	Radioactive† Tracer	.....	.....	.....	.....	.....	(1.7×10^{-7}) (1.7×10^{-9})	.....	.....			1.7×10^{-7} (1.7×10^{-9})
Chemical	Pot. Ferricyanide	.....	.....	3×10^{-5}	.....	.....	.....	.....	.....	1×10^{-4}	.....	6×10^{-5}
	Copper sulfate dip	.....	.....	3.5×10^{-5}	.....	.....	4×10^{-6}	.....	.....	.....	.....	9×10^{-6}

*Values in grams per square centimeter

[1] M. H. Devaux, J. Physique Radium **4**, 293-309 (1923).

[5] J. C. Harris, R. E. Kamp and W. H. Yanko, J. Electrochem. Soc. **97**, 430-432 (1950)

[6] I. Langmuir, J. Franklin Inst. **218**, 143-171 (1934)

[4] H. B. Linford and E. B. Saubestre, Plating **39** (1952)

[8] O. M. Morgan and J. G. Lankler, Ind. Eng. Chem., Anal. Ed. **14**, 725-726 (1942)

†Figures in parentheses give the sensitivity towards the tracer alone

‡The value reported was apparently obtained from a naturally fluorescing mineral oil containing no added dye as tracer.

than to spreading oils (paraffinic, or light oils). Two types of oil distribution were considered (Table I): (1) uniform oil deposits and (2) residues left after alkaline cleaning (discreet globules of oil). It can be seen from Table I that there are two notable differences in results obtained between the two types of oil distribution. The water-break test is 10–30 times less sensitive than the atomizer test with uniform oil deposits (hysteresis effects only), but about 160 times less sensitive with residues after alkaline cleaning (both hysteresis and "bridging" effects). The fluorescent dye test is more sensitive when the dye is concentrated into small areas than when it is uniformly dispersed over the surface. With regard to surface preparation, it was found that on polished surfaces smaller quantities of oils could be detected than on matte surfaces, and that the reverse was true when passive layers produced by chromates were present. It was found also that with members of a homologous chemical series of oils, sensitivity is dependent on the number of molecules present rather than on the mass or thickness of the oil film. With mixed oils consisting of chemically similar substances, wetting appears to be an additive property, but when the substances are dissimilar, a more complex theory is required[103k].

Bearing these variables in mind, Table II can be used to compare the results obtained in this Project with those appearing previously in the literature. In all cases, uniform oil deposits are assumed. The work of Devaux is listed in Table II under the atomizer test, even though Devaux described his work as dealing with the water-break test. However, in carrying out the test, he touched the test surface with the tip of a hot wire, drying the surface locally. He then observed whether or not the remaining water film re-wetted the test area. Such a performance would depend on the advancing contact angle, as does the atomizer test, whereas the water-break test is dependent on the receding angle. It can be seen from Table II that agreement with the literature is good, except in the case of the copper sulfate dip test, where Harris obtained lower values of sensitivity than were obtained by the present authors. It will be seen that the sensitivity of the atomizer test is on a par with the radio-active tracer test, and superior to all others, with the water-break test being the next most sensitive.

Comparing the radio-active tracer and atomizer tests, the radio-active tracer test has one major advantage: the limit of sensitivity can be pushed back indefinitely by improved technique, as the test has practically no inherent limit of sensitivity, something which is not true of the atomizer test. The atomizer test has four major advantages: (a) less expensive by far, (b) may be conducted by persons with little technical training, (c) can be used with any oil already present on the test piece, and (d) readily reveals the distribution of the oil on the test panel.

Oil Spreading Rates

The spreading rates of various oils on metal surfaces were determined[103j]. It was found that commercial oils may be characterized as spreading, partial-spreading, and non-spreading oils. A close correlation was found[103k] between oil spreading rate and wetting test sensitivity. This was found to be probably connected with adsorption and orientation of oil molecules at metal surfaces. Thin stearic acid films were found to render surfaces oleophobic, as well as hydrophobic. Oleic acid films did not exhibit this effect generally.

Standardized Techniques

The "dipping-and-draining" technique was found to be the best for preparing samples for testing of cleaner performance[103d]. It was found that previous reports in the literature often suffered from various objections. To overcome these objections, details were given on a new modification of this standard technique[103d]. The authors realize that this technique may well be imperfect, and that objections of various sorts may be made to it in the future. However, it is hoped that by publications of this method, a stimulus may be given to further thought on the subject. This would be most desirable, as in the past much important and otherwise well performed work has suffered from inadequate attention paid to the question of surface preparation.

BIBLIOGRAPHY

General Bibliography
1–102 Plating **38**, 164–166, 855 (1951); **39**, 62 (1952).
Sprays
199–200 Plating **38**, 855 (1951).
Wettability
203–204 Plating **38**, 855 (1951).
Spreading of Oils
264–274 Plating **40**, 386 (1953).
Multi-layers
275–292 Plating **40**, 645 (1953).
Drop-wise Condensation
294–308 Plating **40**, 645 (1953).
Project References
103a H. B. Linford and E. B. Saubestre, Plating **37**, 1265–1269 (1950).
103b Ibid, **38**, 60–65, 254 (1951).
103c Ibid, **38**, 158–166 (1951).
103d Ibid, **38**, 367–375 (1951).
103e Ibid, **38**, 713–717 (1951).
103f Ibid, **38**, 847–855 (1951).
103g Ibid, **38**, 1157–1161 (1951).
103h Ibid, **38**, 1263–1266 (1951).
103i Ibid, **39**, 55–63 (1952).
103j Ibid, **40**, 379–386 (1953).
103k Ibid, **40**, 489–496, 633–645 (1953).
103l H. B. Linford and E. B. Saubestre, Proc. Am. Electroplaters' Soc. **38**, 169–179 (1951); **39**, 227–231 (1952).

Contribution No. 37 from the Chemical Engineering Department, Engineering Center, Columbia University, New York, N. Y.

Du-Lite

"Gives our tools Sales Appeal"

BARNABY MFG. CO. of Bridgeport, Conn., reports: "Our close proximity to salt water has given us problems in rust prevention for many years. We have experimented with many black oxide finishes but none has proven as successful, safe, and inexpensive as DU-LITE—our tools have better sales appeal—our volume has been on the increase ever since we started using this modern, progressive oxide finish."

Depend on Du-Lite, the metal-finishing specialists, for the most efficient and economical cleaners, black oxide finishes and phosphate coatings. Write for full details on:

- Du-Lite Black Oxide for Steel.
- 3-0 Black Oxide for stainless steel and malleable iron.
- SD Compound for removing occluded salts.
- Phosteel and Phospray for phosphatizing steel, iron or zinc.
- Du-Lite Non-Acid Black Oxide for copper and copper alloys.
- Dynakleen for bright cleaning all metals.
- Kwikseal and Proctoil water displacing oils.

Or send us samples of parts and we will process them for your approval.

DU-LITE CHEMICAL CORP.
MIDDLETOWN, CONN.
Send more information on Du-Lite..... ☐
Send information on metal finishing products.. ☐
Have your representative call..... ☐

Name.....
Company.....
Address.....
City..... Zone..... State.....

Du-Lite
METAL FINISHING SPECIALISTS

INDICATE A 1341.

HOW WOULD YOU SOLVE IT?

1. PRODUCTION PROBLEM:

To produce a more uniform finish on the multiple contours of stainless steel surgical instruments and cut unit costs of finishing and polishing. Witte & Schmitz Surgical Instrument Co. was using set-up wheels which left unsatisfactory finishes, tired operators.

2. SOLUTION:

A 3M Representative suggested that this Bridgeport, Conn. manufacturer switch to the 3M Backstand Method using Three-M-ite "Resinite" and Three-M-ite Cloth Belts. A 3M Methods Engineer helped the firm make up their own spindles and mounted wall idlers to make best use of limited space.

3. RESULTS:

An immediate 25% production increase with a far superior finish on the instruments. Too, the manufacturer found that unskilled workers could be trained to polish the multiple contours more rapidly, and there was less operator fatigue. 3M Representatives can help solve *your* grinding problems, too. Send coupon for facts.

WANT MORE INFORMATION?

Minnesota Mining & Mfg. Co.
Dept. PL-113, St. Paul 6, Minn.

☐ Send me free booklet: "Case History Reports on 3M Abrasive Belts."
☐ Have 3M Representative call.

Name_____ Title_____

Company_____

Address_____

City_____ Zone____ State_____

3M® ABRASIVES

Made in U.S.A. by Minnesota Mining & Mfg. Co. General Offices: St. Paul 6, Minn. In Canada: London, Ont., Can., Export: 122 E. 42nd St., New York City. Makers of "Scotch"® Pressure-sensitive Tapes, "Scotch"® Sound Recording Tape, "3M"® Adhesives, "Underseal"® Rubberized Coating, "Scotchlite"® Reflective Sheeting, "Safety-Walk"® Non-slip Surfacing.

NEW YORK BRANCH HOST

41st Annual A. E. S. Convention

JULY 12-15, 1954

New York Branch History

The following review of the host branch for the forthcoming A. E. S. Convention contains a short summation of current branch activity. Included is an historical summary which is a copy of an address* by the only living National Society Honorary Member of the Branch, Mr. John E. Sterling. Mr. Sterling also served as Supreme President in 1924-25.

The Branch with its membership of over 350 thus ranks as third in size in the parent group. Regular meetings are held twice monthly on the second and fourth Fridays in the Statler Hotel. Its annual Educational Session and Banquet usually are held during February. These events have been noted always for their outstanding educational and social value to the membership.

Mr. Sterling's Historical Review—

To our Members and their friends who are assembled here to join in celebrating the birthday of our Branch—the mother of the A. E. S.—a welcome is extended. This body was organized April 10, 1909, and we feel proud to have had the honor of starting this movement which has become such an important factor in the field of electrodeposition and finishing of metals.

Suppose we go back a few years and recall some of the pioneers of this Society.

The late Mr. Charles H. Proctor conceived the idea of a platers' organization for:

1. A better understanding of the technical and chemical controls of plating solutions;
2. To assist one another to solve the various problems that did and still do arise in plating rooms, and
3. To improve the science of the electrodeposition and finishing of metals.

In January, 1909 he sent letters to several progressive platers asking them to meet to discuss the possibility of forming such an organization.

In February, 1909, several platers met with Mr. Proctor in the Astor House at Broadway and Vesey Street, New York City; among them such well-known platers as: Percy Brown, Ben Gilchrist, Horace Smith, Mat Emery, Dick Sliter, and several others whose names we cannot recall. It was decided to send out a meeting notice to all who showed an interest in the idea and to have the Metal Industry publish such a notice.

The meeting was held at the Hotel Chelsea on March 6, 1909, about twenty men attending this meeting. It was decided to "start the ball rolling" by choosing officers. Mr. Proctor was made Chairman and Mr. Brown was Secretary-protem.

On March 19, 1909 a second meeting was held in the Astor House, at which Mr. George Hogaboom suggested appointing a librarian.

The next meeting was at the Astor House, on April 10, 1909. Forty charter members attended, the Constitution and By-Laws were adopted, and the National Electro-platers Association (Chartered under the laws of N. Y. State) was on its way. The officers were: C. H. Proctor, President; Ben Gilchrist, Secretary; Nathan Emery, Treasurer; George Hogaboom, Librarian and Chairman of Printing (elected at the May 7, 1909 meeting).

Regional Vice-Presidents were: John J. Fannon, New York; Hugh Baxter, New Jersey; John W. Slattery, Connecticut; H. E. Willmore, Illinois, Michigan, Ohio, Indiana.

The Printing Committee consisted of: George Hogaboom, Justus A. Stremel, Harry Bernard and the Advisory Committee: William Schneider, Chairman; Joe Dimes, H. H. Smith, Royal F. Clark and R. H. Sliter.

Meetings thereafter were held in the Hotel Chelsea. Then we began to spread out. Charters were granted to Philadelphia, Chicago, Toronto, Detroit, Rochester, St. Louis and Indianapolis.

The meetings began to get very interesting—so much so, that Mr. Proctor said after one of the meetings that he thought he had an idea when he started out, but he was beginning to think it was a "brain storm".

At this time much discussion was going on. Some of the members wanted to found a Social Club, others a Union, but eventually compromised on an Educational Society. Now we were meeting in the Grand Opera House, and eight cities were represented in the Association.

During the term of Dick Sliter (second president), a committee of three, Charles Proctor, George Hogaboom and John Sterling, was appointed to try to form a Supreme Body to consist of representatives from all the Branches in other cities.

At the fourth Annual Banquet, February 20, 1913, in the Broadway Central Hotel, representatives from Philadelphia, Chicago, Rochester, Toronto, Detroit, St. Louis and Indianapolis met with the New York committee in a room of the Hotel and discussed the proposition until the small hours of the morning and on Sunday they finished their job by creating the American Electroplaters' Society, and elected the following: George Hogaboom, New York, President; J. H. Hansjosten, Chicago, Vice-President; W. S. Burrows, Toronto, 2nd Vice-President; Fred Clements, Philadelphia, Secretary; John J. Schulz, Detroit, Treasurer.

At the election of 1913–1914 Tom Haddow became first Branch President.

In 1913 New York Branch inaugurated afternoon sessions at the yearly banquets and invited the ladies.

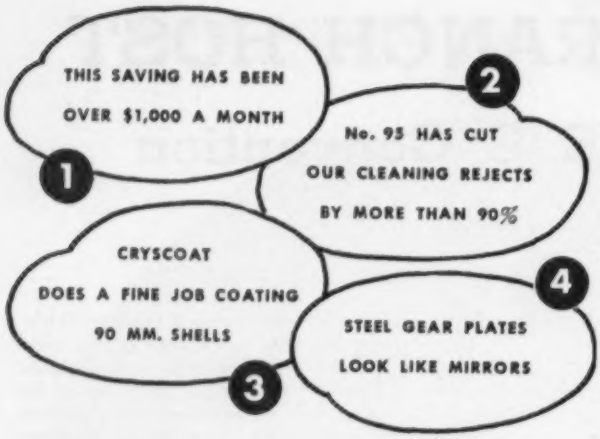
Looking back over the years we can be and are proud of the success and high position it has obtained among scientific societies. Our membership has increased, as well as our standing. Those forty charter members have now increased to several thousand, scattered among the 48 branches, and living in the United States, Canada, Australia, Europe, Asia and Africa.

This seems a good time to call to mind the names of the members who have contributed generously of their time and knowledge to make this growth possible.

Starting with the pioneers in the creation of the N.E.P.A., who were also officers of the Branch, we recall Charles Proctor, founder, of whom we are very proud; Ben Gilchrist, Nat Emery, Percy Brown, George Hogaboom, Dick Sliter, Gus Hoffman, Horace Smith, Royal Clark, John Painter, Bill Fisher, Hugh Baxter, H. H. Reamer, Justus Stremel, Joe Minges, Bill Voss, Ed Faint, Bill Schneider, Harry Bernard, Roy Stout, Tom Haddow, Tom Trumbour, Ben Popper, Harry Flanagan, John Slattery, John Fannin, and Frank Davis. Other tireless workers were: Palmer H. Langdon, A. D. Havens, Harvey Miller, H. E. Willmore, Charles Buchanan, Oscar Hillman, Clarence Fields, Joe Straub, and many others.

With sincere acknowledgments for data in this history to George Hogaboom, Justus Stremel, Bill Fisher, Phil Morningstar and Bill Voss, the writer concludes this history of the New York Branch.

*Presented at the New York Branch banquet in 1951.



We help our customers write success stories

Every day 200 Oakite Technical Service Representatives use Oakite cleaning materials and methods to help thousands of Oakite customers accomplish metal-cleaning jobs that are important parts of big production operations.

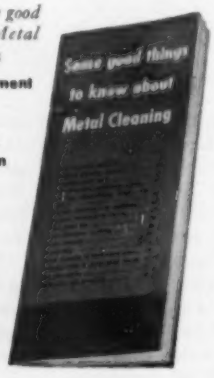
When a busy customer sends a few words of appreciation, we treasure those words as a *success sentence* that we have helped write in his *success story*. Here are brief explanations of the *success sentences* quoted above:

1. After 6 months use of Oakite Special Protective Oil for preventing rusting, this manufacturer of precision steel parts estimated savings at more than $6,000.
2. The use of Oakite Composition No. 95 for conditioning zinc-base die castings before plating cut cleaning rejects for this hardware manufacturer and showed other "very fine advantages."
3. Oakite CrysCoat HC put a heavy phosphate coating on 385,000 shells with "absolutely no trouble" according to a munitions maker, who added that "maintenance and control are very easy."
4. For burnishing, "Oakite Composition No. 3 is here to stay" says this maker of aircraft instrument parts, who adds "Pinions are polished to the roots of the gears. Magnesium parts are brilliant."

How about your success story? We'll be glad to tell you how we can help. Just drop a note to Oakite Products, Inc., 40 Rector St., New York 6, N. Y.

FREE Ask for our booklet "*Some good things to know about Metal Cleaning.*" It discusses our methods for:

Tank cleaning	Pre-paint treatment
Machine cleaning	Burnishing
Electrocleaning	Paint stripping
Pickling, deoxidizing	Rust prevention



SPECIALIZED INDUSTRIAL CLEANING
OAKITE
MATERIALS • METHODS • SERVICE

Technical Service Representatives in Principal Cities of U. S. and Canada

Book Review

DR. HAROLD J. READ

Professor of Metallurgy, Pennsylvania State College

DETERGENTS—What they are and what they do, by Donald Price, 159 pages, 1952. The Chemical Publishing Company, Inc., 212 Fifth Avenue, New York 10, N. Y. Price, $4.00.

In this little book, the author has attempted, in language suitable for the layman, to present a review of the history, nature and uses of detergents. Although it is not easy for a technically trained reviewer to assess the merits of a book for the layman inasmuch as there is difficulty in putting aside momentarily the technical background with which he has lived for many years, it appears that Dr. Price has succeeded admirably in fulfilling his objective. Surely any layman will be able to understand most of the book, and even those passages in which the technical aspects of the discussion are somewhat beyond him will probably titillate his imagination rather than discourage further reading.

The author's wide experience in addressing groups of individuals whose knowledge of detergents was nil is reflected in his apt and easily understood analogies, a pedagogic device of which he makes extensive use.

It would seem, however, that the rather high price of the book would, in considerable measure, defeat its intended purpose. An entire chapter, for instance, is devoted to household detergents, but it appears unlikely that many housewives would divert four dollars from their household or personal budgets to purchase the book. There are very few figures or expensive handset formulas or equations to justify the price.

The plan of the book is excellent. The author explains first what detergents are and then progresses to an interesting account of the history of the development of synthetic detergents wherein he includes a certain amount of basic information on the classification and the basic nature of the synthetic materials. He next outlines the theories of wetting, emulsification and other phenomena encountered in cleaning operations, and follows this with a chapter on household detergents and another on industrial cleaners. Both of these chapters are informative, sensible and well related to the preceding presentation of fundamentals. The final chapters on testing and choosing detergents and on predictions as to the future of detergents measure up to the quality of the rest of the book. The few passages which are technically somewhat misleading are probably the result of brevity or the necessity of avoiding technical complexities.

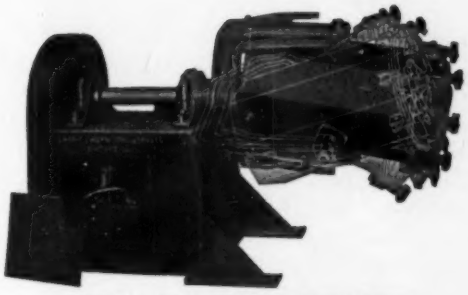
It would appear that operators or foremen of any shop where cleaning is an operation could with profit make available copies of this book for circulation amongst their workmen.

USE "RELIANCE" PRODUCTS FOR

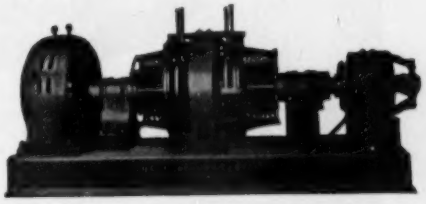
ECONOMY : EFFICIENCY : DEPENDABILITY

LET US SUPPLY YOUR NEEDS FOR YOUR PLATING OR POLISHING DEPARTMENT

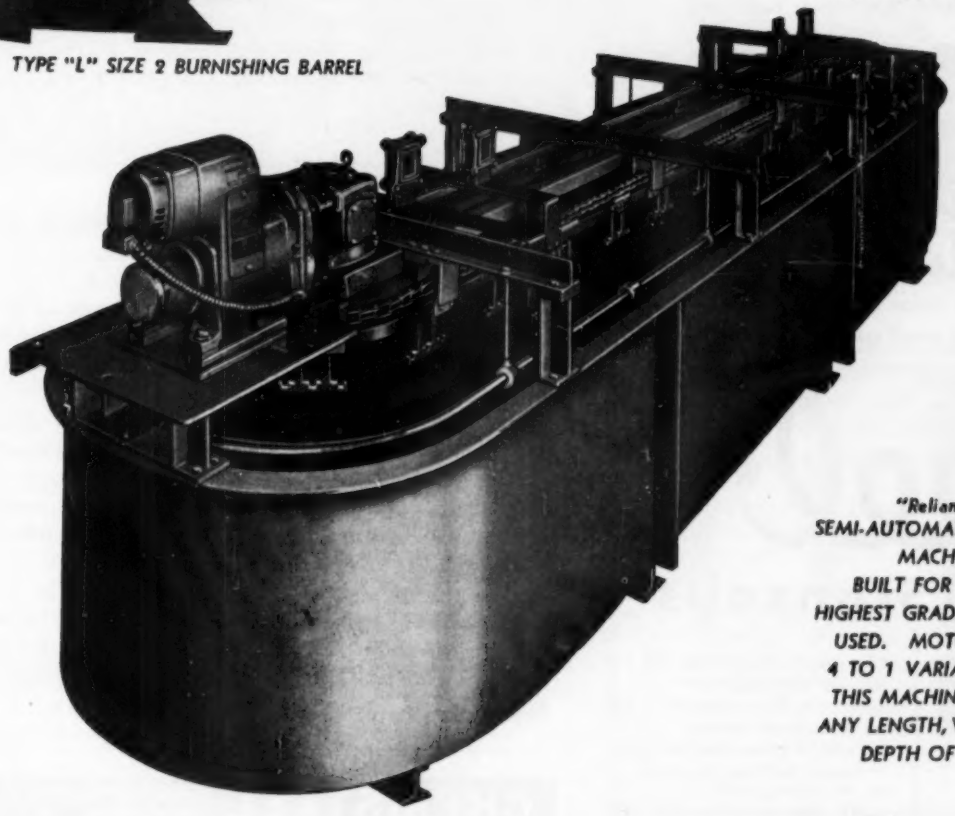
WRITE FOR FURTHER DETAILS



TYPE "L" SIZE 2 BURNISHING BARREL



3000 AMP. 6 VOLT GENERATOR SET



"Reliance"
SEMI-AUTOMATIC PLATING MACHINE
BUILT FOR SERVICE
HIGHEST GRADE MATERIAL USED. MOTOR ½ HP
4 TO 1 VARIABLE SPEED.
THIS MACHINE IS BUILT ANY LENGTH, WIDTH AND DEPTH OF TANK.

Chas. F. L'Hommedieu & Sons Co.

MANUFACTURERS of

Plating and Polishing Machinery

Complete Plating Plants Furnished

Chas. B. Little Co.
Newark, N. J.

W. R. Shields
Detroit, Mich.

O. M. Shoe
Philadelphia, Pa.

Gen. Office and Factory:
4521 Ogden Ave.

CHICAGO

Branches:
Cleveland
and
Los Angeles

For a plastisol rack coating that meets all your requirements...

USE Chem-O-Sol (plastisol formulation)

As one of the early producers of plastisol coatings for the plating industry, we have regularly improved our Chem-O-Sol (plastisol coating) to keep pace with your current needs. Latest development is a Chem-O-Sol specially formulated for superior resistance to chlorinated degreasing solvents.

All Chem-O-Sol coatings have exceptionally good heat and chemical resistance. They are tough coatings — made to stand up day after day under difficult conditions. And, of course, they never contaminate commercial plating solutions.

HAVE YOU INVESTIGATED CHEM-O-SOL? If not, write for free sample and technical details at no obligation. Make sure *you* are using the latest, improved coatings for your job requirements.

Formulators of lacquers, coatings, and finishes you can depend on!

Chemical Products CORPORATION

105 KING PHILIP ROAD, EAST PROVIDENCE, R. I.

USE READER SERVICE CARD; INDICATE A 1345.

Hold an eel with Super-Safe Grip PIONEER Stanzoils®

N-74 Rugged heavy weight all-neoprene 18" length. Snug curved fingers Super-Safe grip surface.

Non-slip grip on Stanzoils handles wet, slippery objects as if dry. Speeds work—cuts accidents. PIONEER Processed *milled* neoprene gives extra hours use in contact with oils, acids, alkalies, solvents—has higher tensile strength, greater tear resistance than any other oil-proof rubber. Only a liquid-tight glove gives positive physical protection from conditions causing dermatitis.

32 PIONEER styles, weights, sizes and colors. Send for Stanzoil catalog —shows quickly how to pick the best, most economical glove for each job.

The PIONEER Rubber Company 291 Tiffin Road Willard, Ohio

STANZOIL PIONEER

Article Abstracts

No copies of articles are available at the offices of "Plating". Photostats may be had from libraries having files of the journal in question and offering photostat service, usually at 30-50 cents a page. Ask your public library to consult the Union List for names of libraries having the particular journal. Abbreviations used are those of Chemical Abstracts.

Control of Bright Nickel Solutions. H. Robins. Presented at the A. E. S. Federal Convention, Melbourne, Australia, May 1953.

This paper deals with the control of bright nickel solutions from three main aspects. (a) The effect of the chemical constitutents of the bath and their control by chemical analysis. (b) The operating conditions such as agitation, anode area, temperature, etc. (c) The effect of impurities on the deposit and the removal of these impurities. Emphasis is placed on the effect and removal of iron and organic impurities from bright nickel baths.

Hydrogen Blisters In Brass Sheet. R. Eborall, and A. J. Swain. J. Inst. Metals, **81**, 497, 1953.

Blisters appearing near the centre plane of brass sheet were attributed to hydrogen collecting and persisting in central voids of the cast slab, so that these voids did not weld up during rolling; expansion of the compressed hydrogen on annealing the brass after it had been reduced to thin sheet and so unable to withstand the stresses produced, caused the appearance of blisters. It was found that hydrogen was lost during annealing, and an effective remedy was developed based on this observation and on a proposed mechanism of blistering. Approximate measurements of the solubility of hydrogen in solid 2:1 brass gave values somewhat lower than the published values for copper.

Engineering Uses of Electroplating in the Aircraft Industry. D. W. Glanvill. Presented at the A. E. S. Federal Convention, Melbourne, Australia, May 1953.

CHEMSTEEL CONSTRUCTION COMPANY, INC.

303 Chemsteel Building, Walnut Street, Pittsburgh 32, Pa.

(No "tie-in" with any manufacturer)

Send data on your Design, Engineering, Material, Construction and Maintenance Facilities for

ACID-ALKALI-PROOF CONSTRUCTION

backed by experience serving major steel, chemical, textile and food industries in erection of

PICKLING, PROCESSING & STORAGE TANKS & FLOORING

NAME .....

COMPANY .....

ADDRESS .....

CITY ..... ZONE ..... STATE .....

(TEAR OUT AND MAIL)

USE READER SERVICE CARD; INDICATE A 1347.

ONE OF A SERIES OF ADVERTISEMENTS ON THE HISTORY OF ELECTROPLATING

a gamble that gave birth to the rectoplater

—workhorse of the plating industry!

One hot summer evening, back in 1937, L. K. Lindahl and John Bogel, his neighbor and associate, were in Lindahl's living room, still debating after three months of "rocking chair conferences," the desperate need for a rectifier made in the U.S.A.—a standardized production unit that would meet the electroplater's requirements.

Suddenly, Lindahl said, "John, I'm tired of waiting on those expensive, unreliable imported rectifiers. Let's gamble and build our own rectifier for Udylite customers." "Let's do it," John agreed.

And so the Udylite Rectoplater was born. Udylite went to Mallory, who had been making copper sulphide units for use in radios and battery chargers. Lindahl and Bogel, together with Mallory engineers, soon designed a 1500 amperes rectifier. They backed up their judgment with an order to Mallory for 100 of these units that have since made history because:

1. The Udylite Rectoplater outperformed any other method of converting current and sold for half the price.
2. Engineered for the plating shop—the Udylite Rectoplater performed perfectly under the most adverse conditions.
3. The standardized Rectoplater was a stock item—ready for immediate delivery to Udylite customers.

It was this same Udylite Rectoplater that broke the bottlenecks of plating production in the dramatic days of World War II—established it as the Workhorse of the Plating Industry. Udylite was able to furnish these desperately needed direct current rectification units on a "same day" delivery basis!

Over the years Udylite improved the original Rectoplater. Continuous research and experimentation led to the perfection of the newest, most modern Udylite selenium Rectifier . . . a basic improvement on the well-known Rectoplater. The Udylite program of research never stops, and the rectification units of tomorrow which mean more production, more profit to you, are already in pilot stages at our modern Udylite research laboratory.

This is just another one of the many contributions made by Udylite to the art of modern electroplating.

PIONEER OF A BETTER WAY IN PLATING...

THE Udylite CORPORATION
DETROIT 11, MICHIGAN

FILTER 50-1500 GAL/HR ANY ELECTROPLATING SOLUTION

NO ROUGH DEPOSITS
NO PITTING

SERVICE: Filters practically any acid or alkaline solution from pH 0 to pH 14; removes particles down to one micron in size.

DESIGN: Filter Assembly fabricated of stainless steel 316, high temperature lucite, rubber-lined, Haveg or Sethrin* resin. Filter tubes of cotton, dynel, porous stone, or porous carbon. Pumps fabricated of Hastelloy, stainless 316, or plastic; centrifugal or self-priming. Motors drip-proof, totally enclosed, or explosion-proof, 110 or 220 volt, single or three-phase, 50 or 60 cycle, sleeve or ball bearing. Hose—12 ft. inlet and 12 ft. outlet, acid and alkaline resistant. Base—Phenolic base on rubber tire ball bearing casters.

*Reg. App. For

Distributors in Principal Cities

Model	Rated Capacity	Overall Size	Weight
LSI-5	50 gal/hr	11" x 14" x 12"	30 lb
LSI-10	100 gal/hr	12" x 16" x 16"	40 lb
ASI-300	300 gal/hr	2' x 2' x 2'	125 lb
ASI-400	400 gal/hr	2' x 2' x 2'	135 lb
ASI-600	600 gal/hr	2' x 2' x 2'	150 lb

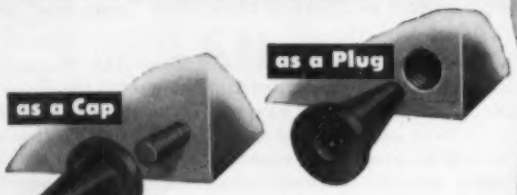
Write for Literature

Sethco 72 Willoughby St., Brooklyn 1, New York

USE READER SERVICE CARD; INDICATE A 1349.

For Metal Finishers!

Pressure Moulded NEOPRENE **"CAPLUGS"**



7 STANDARD SIZES

	A	B	C	D	E	F	G
TO PLUG HOLE SIZE	1/8-3/16	3/16-1/4	1/4-5/16	5/16-1/2	1/2-5/8	9/16-11/16	5/8-3/4
TO CAP STUD SIZE	3/32-5/32	5/32-3/16	3/16-1/4	1/4-5/16	5/16-3/8	3/8-7/16	5/16-1/2

MASKING PROBLEMS OUR SPECIALTY!

WRITE FOR FREE SAMPLE KIT...

DUGGAN Masking Devices

2030 WEST FORT STREET
DETROIT 16, MICHIGAN

Article Abstracts

A surprisingly large field of use for electroplating occurs in the construction and maintenance of aircraft engines. This paper outlines purposes for which plating is used, and the many special factors governing choice of metal to be deposited on the different parts of engines. Various metals and combinations of metals are used for plating of bearings and of parts involved in interference fits. Metals commonly used are copper, silver, nickel, chromium, lead and indium. Very special care is essential at all stages in preparation and plating of engine parts, as any shortcomings or failures could have most serious results. Special problems arise, for example, in securing the best adhesion to the variety of alloy steels used. Methods of testing adhesion are described.

Electronic Configuration in Electrodeposition from Aqueous Solutions. III. Deposition from Certain Metal Complexes*. Ernest H. Lyons, Jr., John C. Bailar, Jr., and Herbert A. Laitinen.

The cathodic behavior of cobalt, nickel, copper, and zinc complexes of 8-hydroxyquinoline-5-sulfonic acid, 1, 10-phenanthroline, glycine, naphthalenediamines, tetramethylethylene-diamine, and dimethylglyoxime was investigated by determining cathode efficiencies and polarograms. Deposition was not obtained from ions believed to have hybridized orbitals involving the penultimate electron shell, that is, from the "inner orbital" complexes of Taube. Deposits were obtained from "outer orbital" ions, thus confirming the rule previously proposed. Evidence is given that copper, as well as cobalt and nickel, forms ions of both types.

Note on the Protection of Mild Steel by Films of Lanolin. E. G. Stroud and J. E. Rhoades-Brown. J. Applied Chem. **3**, 287 (1953).

Experimental outdoor exposure data are presented to show that, where lanolin is used for the temporary protection of steel and is applied from a solution in white spirit or mineral oil, the concentration of lanolin in either solvent must not fall below 12½ per cent if efficient protection is to be achieved.—D. G. FOULKE.

The Interaction of Organic Compounds with the Surface During the Electrodeposition of Nickel*. Clayton C. Roth and Henry Leidheiser, Jr.

Correlations were drawn between the structures of 76 organic compounds and their effect on the cathode potential. Brittleness, peeling and cracking of the deposit occurred at high cathode potentials. Adsorption experiments with Raney nickel and measurements of the electrode potential in 1N HCl indicated that the compounds most effective in increasing the cathode

*Presented at the Electrochemical Society meeting at Wrightsville Beach, N. C. (1953).

Famous . . . "shining examples"

Carlton STAINLESS STEELWARE

. . . Polished with

EXOLON Abrasives

"the bright finish starts the sale"

We are proud that the CARROLLTON Manufacturing Company uses Exolon abrasives to give its stainless steelware the eye-catching, sales-starting, high-lustre you see above. Exolon abrasive grains have proved their efficiency in every polishing situation.

These grains — made to unvarying high standards — have sharp cutting edges, are uniform in size and shape, and are specially treated to improve adhesion. Iron particles are removed. Such manufacturing uniformity insures *you* of faster, easier polishing, uniformly fine finishes with substantial savings of time, labor, and abrasive material.

Write today for full information on how EXOLON ABRASIVES will make your products look better and sell better, while reducing production costs.

The EXOLON Company

973 EAST NIAGARA STREET TONAWANDA, NEW YORK

MANUFACTURERS OF SILICON CARBIDE AND ALUMINUM OXIDE ABRASIVES

Ceilcrete

a stonelike corrosion proof trowelled on surface

✓ ACID PROOF
✓ ALKALI PROOF
✓ SOLVENT PROOF

TOPPING for FLOORS • WALLS
ACID HOLDING TANKS • WASTE
DISPOSAL SYSTEMS, ETC.

THE CEILCOTE COMPANY
4832 Ridge Road, Cleveland 9, Ohio

Send for technical data on its application, corrosion resistance properties

USE READER SERVICE CARD; INDICATE A 1352.

Estox

Perma Black Process

18-8 stainless steel springs blackened to government specifications in addition to all other ferrous metals

Operating costs reduced 40%

F. O. B. New Haven, Detroit

Estox
TRADE MARK REGISTERED
PRODUCTS

Perma Black Metal Cleaners Brazing Flux | Soluble Oil Additives

STANDARD RESEARCH, INC.
462B Grand Avenue, New Haven, Connecticut

Article Abstracts

potential were readily adsorbed by nickel. X-ray measurements indicated that the compounds which affected the potential also interfered with crystal growth.

Role of Shape of Colloidal Molecules in Electrolytic Metal Deposition*. S. Levy.

The changes in electrolyte at the cathode caused by two types of colloidal molecules are discussed. Specific mechanisms of influence on electrodeposits are suggested for each type: the elongated and the sphere-like molecules.

The Effects of Ultrasonic Waves on Electrolytes and Electrode Process. S. Barnartt. Quarterly Reviews **7**, No. 1, 84 (1953).

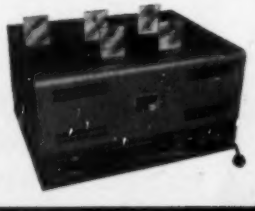
When acoustic waves are propagated through a medium, the particles of the medium are subject to periodic accelerations and compressions and the changes of velocity, pressure and temperature cause the effects of acoustic waves on properties of the medium and the reactions taking place therein. The author reviews these ultrasonic wave effects with respect to compressibility, conductivity, space charge (the Debeye Effect) and electrode potentials. In the latter discussion unpolarized and polarized electrodes are covered and a curve is shown for the variation of hydrogen deposition potential with current density in the presence of strong agitation and intense ultrasonics. The effect of ultrasonics on electrodeposition processes also is discussed in detail. Seventy-three references.—D. G. FOULKE.

Adherent Electroplating on Molybdenum*. Robert M. Hansen and Charles L. Mantell.

Four detailed methods of securing adherent plating on molybdenum are described in detail with regard to preliminary surface preparation and plating methods.

*Presented at the Electrochemical Society meeting at Wrightsville Beach, N. C. (1953).

PERIODIC-REVERSE UNITS



Of the Finest Quality for

PLATING

In the Modern Way

Write for Information

UNIT PROCESS ASSEMBLIES, Inc.
75 East 4th St. New York 3, N. Y.

USE READER SERVICE CARD; INDICATE A 1353.

USE READER SERVICE CARD; INDICATE A 1354.

Patent Abstracts

GEORGE B. HOGBBOOM
Consultant, New Britain, Conn.

Copies of patents may be obtained by writing to Commissioner of Patents, Washington, D. C. Price 25 cents each.

No. 2,646,398, July 21, 1953—Electroprocessing Apparatus—H. P. Henderson, assignor to General Motors Corporation.

CLAIM 3. In an electroprocessing apparatus, a cleaning tank, a plating tank, said tanks being arranged to contain treatment solutions, the ends of said tanks being respectively provided with aligned weirs through which the solutions may flow from the tanks, pump mechanism for receiving the solutions flowing from said weirs and for feeding the solutions up into the bottoms of said tanks for maintaining the solutions flowing into the weirs at predetermined levels, a work holder for supporting a work piece, and means to feed the work holder in a substantially straight horizontal path for transporting the work piece through a weir into submersion within the first tank and out of this tank through another weir thence through another weir into second tank solution and out of solution through the last weir.

7 claims, 5 figures.

References cited: U. S. Patents 1,220,260; 1,298,155; 1,574,823; 1,768,358; 1,959,764; 2,085,730; 2,387,160; 2,428,141. German Patent 629,668.

No. 2,647,866, August 4, 1953—Electroplating of Nickel —Henry Brown, assignor to The Udylite Corporation.

CLAIM 1. A bath for electrodeposition of bright nickel comprising an aqueous acidic solution of at least one nickel salt selected from the group consisting of nickel chloride and nickel sulfate, said bath also containing, in solution, not more than about 1.5 per cent of at least one brightener selected from the group consisting of organic sulfonamides, sulfonimides and sul-

BEAM-KNODEL CO.

Distributors for
HANSON-
VAN WINKLE-
MUNNING CO.'S

"PLATEMANSHIP"

A Complete Service
for Electroplating,
Polishing and Buffing,
Cleaning and Anodizing

195 LAFAYETTE STREET
CA 6-3956-7 New York 12, N. Y.

USE READER SERVICE CARD; INDICATE A 1356.

Simplify purification of your cyanide zinc plating solution with

McKeon's Zinc-Brite

CUTS DOWN
"BRIGHTENER" CONSUMPTION

Wire or phone collect for information

Sulphur Products Co. Inc.
228 McKeon Way
Greensburg, Pa.

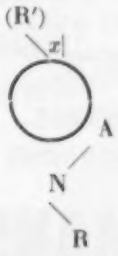
USE READER SERVICE CARD; INDICATE A 1357.

YOU CAN WIN $125

worth of ELECTROPLATING KNOW HOW by writing 250 words or less on "What I Like and Dislike About the Electroplating Industry". Send today for a free entry blank and helpful hints. Contest closes December 1. Joseph B. Kushner Electroplating School, Stroudsburg 3P, Penna.

USE READER SERVICE CARD; INDICATE A 1355.

fonic acid, and, in addition, about 0.003 to 0.15 gram per liter of a bath-soluble compound in accordance with the formula



where

represents a compound of the pyridine series selected from the group consisting of pyridine, quinoline, iso quinoline and C-methyl and ethyl homologues thereof, A is an ion of water-soluble acid, R is an aliphatic radical containing from 1 to 4 carbon atoms, R′ is halogen selected from the group consisting of chlorine and bromine, and x is zero to 2.

18 claims, 3 tables.

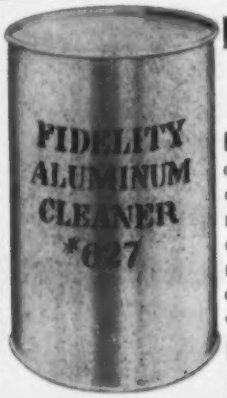
References cited: U. S. Patents 2,238,861; 2,315,802; Raub et al, "Metal Finishing", August, 1940, pp. 429–432.

No. 2,648,626, August 11, 1953—Method of Electrolytic Coating—J. S. Buser (deceased) by Doris E. Morgan (formerly Doris E. Buser), assignor to National Steel Corporation.

CLAIM 1. The method of continuously and progressively manufacturing electro-tin plated strip comprising the steps of passing strip through an electrolytic cell containing an acid plating bath of aqueous electrolyte solution including tin salt and fluorine ions, a source of fluorine ions being a tin-free acidic fluorine compound present as a component of the electrolyte solution, electrodepositing a layer of tin on the strip while the strip is in contact with the electrolyte solution, thereafter passing the strip from the plating bath with tin-salt containing electrolyte solution carried from plating bath on the strip, rinsing the strip with an aqueous rinse solution to remove electrolyte solution including tin salts from the strip by alternately spraying the aqueous rinse solution onto the strip and squeezing the resulting solution from the strip, the first spraying and squeezing operation diluting concentration of tin salts in the solution remaining on the strip and each subsequent spraying and squeezing operation further diluting the concentration of tin salts in the residual solution remaining on the strip, thereafter rinsing the strip with an aqueous rinse to remove residual electrolyte solution including tin salt remaining on the strip after being alternately sprayed and squeezed, said last-mentioned aqueous

Fidelity

ENGINEERED COMPOUNDS



FIDELITY ALUMINUM CLEANER No. 627

SAFE · FAST · EFFICIENT

FIDELITY ALUMINUM CLEANER No. 627 is unexcelled for cleaning aluminum, aluminum alloys and other metals. Used according to instructions, it will not attack aluminum or aluminum alloys . . . nor damage or etch the most highly polished surfaces. It is a mixture of mild alkalis and special wetting agents . . . expertly blended to do a superior cleaning job.

Write, detailing your metal cleaning problems. Our Laboratory Staff will be glad to make recommendations . . . no obligation, of course!

SPECIALISTS IN METAL CLEANERS AND PAINT STRIPPERS

FIDELITY CHEMICAL PRODUCTS CORP.

477 Frelinghuysen Avenue, Newark 5, New Jersey

for

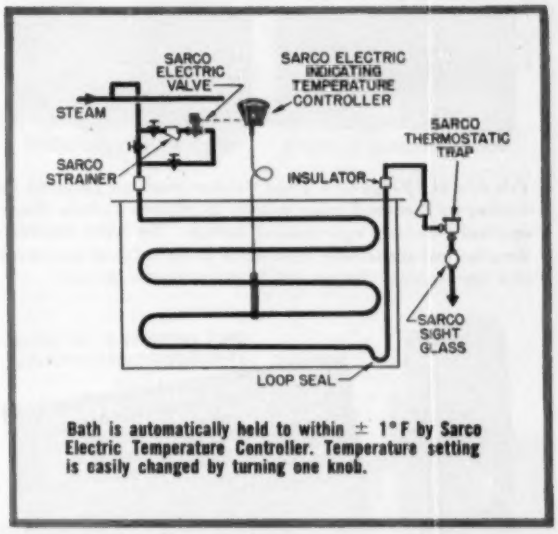
METAL FINISHING & PLATING

How control of tank temperatures

improves product quality—

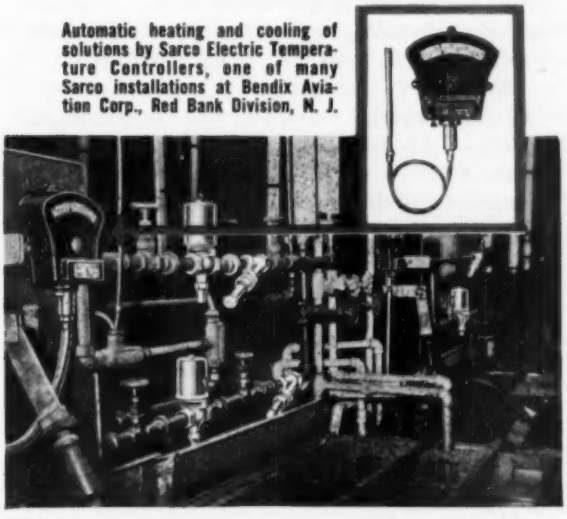
cuts operating costs

3 ways



Bath is automatically held to within ± 1°F by Sarco Electric Temperature Controller. Temperature setting is easily changed by turning one knob.

HERE'S HOW! Sarco electric temperature controllers soon pay for themselves by eliminating the inherent wastefulness of manual controls. Completely automatic operation saves plating materials, insures quality control by keeping temperatures where they belong at all times. Your tank-operating costs are cut three ways:



Automatic heating and cooling of solutions by Sarco Electric Temperature Controllers, one of many Sarco installations at Bendix Aviation Corp., Red Bank Division, N. J.

1. **You lower rejects** because solutions are held automatically to plus-minus 1°F. No chance for human error to mess up a tankload . . . and cut into profits.

2. **You save plating solutions** because automatic control prevents boil-off caused by creeping temperaure.

3. **You save steam** because you use only enough to keep bath at proper temperature.

You can equip your tanks with a Sarco Electric Temperature Control System for as little as $130 a tank. Sarco controllers not only hold temperatures automatically but also indicate the temperatures being maintained and are easily adjustable for different jobs.

For complete information on the advantages of Sarco temperature controllers, write for Technical Bulletin No. 6. Sarco Company, Inc., Empire State Building, New York 1, N. Y. Representatives in principal cities.

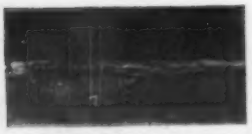
SARCO

improves product quality and output

TEMPERATURE CONTROLLERS • STEAM TRAPS • STRAINERS

Pressure Blast Application #182

BEFORE PRESSURE BLASTING



AFTER PRESSURE BLASTING

This strip of 430 type 14 gauge stainless steel was prepared for welding by Pressure Blasting in order to achieve a clean, microscopically etched, easy-to-bond surface. The weld discoloration, flux and spatter were removed in 10 seconds with no measurable loss of stock! Micro-inch finish was improved, too!

ONLY PRESSURE BLAST GIVES YOU 2-SPEED WET-BLASTING

FREE . . . Learn what PRESSURE BLAST can do for you! Die and Mold Polishing, Blending Grind Lines, Deburring, Heat Treat Scale Removal, Honing of Cutting Tools, Pre-plating Cleaning . . . Hundreds of proven, money-saving applications!

Write for our new 8 page fully-illustrated Booklet . . . or send samples of work you want tested to:

MODEL A . . . ONE OF 4 STANDARD UNITS. CUSTOM MACHINES DESIGNED TO FIT SPECIAL REQUIREMENTS.

The PRO-PLATE Company Incorporated
747-1 Windsor Street
Hartford 5, Conn.

USE READER SERVICE CARD; INDICATE A 1360.

For Immediate Delivery

NICKEL CYANIDE

• SPEKLEEN No. D66 DRYING OUT SOAP
Eliminates Spots or Drying out Stains
Compatible with Lacquer Coatings

Write for Particulars

SPECIAL CHEMICALS CORP.
30 IRVING PLACE, NEW YORK 3, N. Y.

USE READER SERVICE CARD; INDICATE A 1361.

today's "wonder drug" for industry

SAVES UP TO 95% OF FINISHING COSTS!

SUPERSHEEN SPEED FINISHING does away with costly hand deburring and other expensive hand operations. A single unit replaces from 2 to 12 men.

Get the facts! WRITE TODAY for NEW, FREE 52-Page Catalog
Dept. C-11

ALMCO Supersheen
AMERICA'S LARGEST MANUFACTURER OF ADVANCED BARREL FINISHING EQUIPMENT—MATERIALS AND COMPOUNDS
ALBERT LEA, MINNESOTA

Patent Abstracts

rinse being obtained by admixing water and a tin-free acidic fluorine compound, said free tin-free acidic fluorine compound being in an amount sufficient to reduce the *p*H value of the aqueous rinse to a point where hydrolysis of tin salt carried from plating bath on the strip and not removed by the alternate spraying and squeezing is substantially prevented, and utilizing aqueous rinse solution from said last-mentioned rinse step as the aqueous rinse solution for said spraying steps.

5 claims.

References cited: U. S. Patents 2,330,609; 2,372,599; 2,407,579. British Patent 546,269.

No. 2,648,627, August 11, 1953—Bright Nickel Plating Composition and Process—Harold G. Donnelly, assignor to Wagner Brothers, Inc., Detroit, Mich.

EXAMPLE 3

Combined type bath	*oz/gal*
$NiSO_4 \cdot 6H_2O$	25.1
$NiCl_2 \cdot 6H_2O$	20.9
Boric Acid	3.9
Beta-isothioureidopropionic acid	0.33
*p*H electrometric	5.0

EXAMPLE 4

All chloride bath	*oz/gal*
$NiCl_2$	35.19
Boric Acid	3.1
Beta-isothioureidopropionic acid	0.33
*p*H electrometric	5.0

CLAIM 1. An acid aqueous nickel plating bath containing nickel salts, an acid buffering agent, and at least partially water-soluble organic compound containing an isothioureido nucleus and having an organic radical attached to the sulfur atom of the nucleus said organic compound being dissolved in said bath in sufficient quantity to produce bright nickel plating therefrom.

CLAIM 11. A nickel plating bath containing chloride and nickel sulfate ions, less than about one per cent of a wetting agent, an acid buffer sufficient to maintain the *p*H of the bath in the range between 2.5 and 5.5 and about 0.1 per cent beta-isothioureidopropionic acid.

11 claims, 5 examples.

References cited: British Patent 553,781. Raub et al Metal Finishing June, 1940, pp. 315–317.

No. 2,648,628, August 11, 1953—Electroplating of Nickel—Henry Brown, assignor, The Udylite Corporation.

CLAIM 1. A bath for the electrodeposition of bright nickel comprising an aqueous acidic solution containing at least one nickel salt selected from the group consisting of nickel chloride and nickel sulfate, said bath

also containing, in solution, not more than 15 grams per liter of at least one brightener selected from the group consisting of organic sulfonamides, sulfonimides and sulfonic acids, and in addition, from about 0.005 to about 0.04 gram per liter of bath-soluble compound in accordance with the formula

where

N

represents a compound selected from the group consisting of quinoline, isoquinoline and C-methyl and ethyl homologues thereof, R is halogen, and x is zero to 2.

12 claims, 3 tables.

References cited: U. S. Patents 2,238,861; 2,315,802. Raub et al, Metal Finishing, August 1940, pp. 429–432.

No. 2,649,361, August 18, 1953—Method of Dissolving Metals and Composition Thereof—Richard Springer, Leipzig, Germany, Walter R. Meyer, Hamden, Conn., assignors to Enthone, Inc.

CLAIM 1. A metal dissolving composition for dissolving metals by chemical action containing at least one water-soluble alkali cyanide that is ionizable in water to the extent to yield at least 2.5 grams of cyanide radical per liter of aqueous solution, and at least one nitro-substituted aromatic compound capable of producing an electrical potential of minus 0.9 volt or higher between a sheet nickel electrode and a potassium chloride calomel electrode, the nitro-benzo grouping of the nitro-compound being, by weight, equal to more than one tenth of one per cent of the cyanide radical and the composition being alkaline in reaction and being substantially free from nickel, copper, cadmium, silver, zinc, and gold.

14 claims.

No. 2,649,409, August 18, 1953—Electrodeposition of Selenium—A. Von Hippel and Mortimer C. Bloom, assignors by mesne assignments to Federal Telephone and Radio Corporation.

What is claimed is: The process for electrodepositing gray crystalline metallic selenium upon a surface of an article from the group consisting of nickel, silver, antimony and steel, that comprises producing an initial coating of selenium of said surface thereon, and then making the article the cathode in an electrolyte consisting of an aqueous solution of sulfuric acid having a concentration of about 18 normal, and having between 150 grams of selenium dioxide per liter and sufficient selenium dioxide to form a saturated solution dissolved therein, maintaining the temperature of said electrolyte between 55° C and 120° C, and maintaining the current density between 8 amperes per square foot and 230 amperes per square foot.

1 claim, 5 figures.

For the
OYSTER'S
COMFORT

The oyster shell, rugged and rough on its exterior, is lined with a fine, smooth, highly-polished glaze to protect its occupant, Mr. Oyster. If a grain of sand intrudes, it too is promptly protective-covered—forming a valuable pearl.

Protective linings and coverings, specifically formulated to meet the corrosion or abrasion problems of *your* equipment, are our business. Long-wearing rubber or synthetic sheeting can be applied in our plant, or in yours by skilled field crews.

Unusually fast delivery is our strong point—especially when new steel construction is needed, since Acme-Fisher does the complete job. And our prices are right. Ask us for an estimate.

ACME-FISHER
LOUISVILLE 2, KENTUCKY
Anti-corrosive Linings and Coverings
NO EQUIPMENT TOO LARGE or TOO INTRICATE

USE READER SERVICE CARD; INDICATE A 1363.

WANTED

PLATER FOREMAN

Experienced on Silver, Brass and Oxidized Finishes.

Excellent opportunity for man capable of being a leader and producer of quality products.

Chicago Firm
Reply to: P-1153-D, PLATING
445 Broad St., Newark 2, N. J.

FOR SALE

Slightly Used BUFFS

Loose and Sewed
Air-Cooled

Any Quantity

MICHIGAN BUFF CO., INC.
3503 GAYLORD AVE. DETROIT (12), MICHIGAN

USE READER SERVICE CARD; INDICATE A 1365.

References cited: U. S. Patents 1,743,160; 2,197,497; 2,202,532; 2,266,922; 2,408,116. German Patent 525,664. La Ricerca Scientifica, Vol. 100 (1939), pp. 1143 and 1144; article by Sella.

No. 2,651,608, September 8, 1953—Electrodeposition of Aluminum from Nonaqueous Solutions—Abner Brenner and Dwight E. Couch, assignors to the United States of America as represented by the Secretary of Commerce.

CLAIM 1. A process of electroplating that comprises electrodepositing aluminum from a bath consisting of a mixture of an ether selected from the group consisting of ethyl ether, ethyl n-butyl ether, a mixture of ethyl and butyl ethers, anisole, phenetole, and di-phenyl ether; a metal hydride at 0.5 to 1 molar selected from the group of a mixture of an ether, selected from the group consisting of ethyl ether, ethyl n-butyl ether, a mixture of ethyl and butyl ethers, anisole, phenetole, and di-phenyl ether; a metal hydride at 0.5 to 1 molar selected from the group consisting of lithium hydride, lithium aluminum hydride and aluminum hydride; and anhydrous aluminum chloride at from 1 to 4 molar, and at current densities of from 0.5 to 5 amperes per square decimeter.

6 claims, 2 tables.

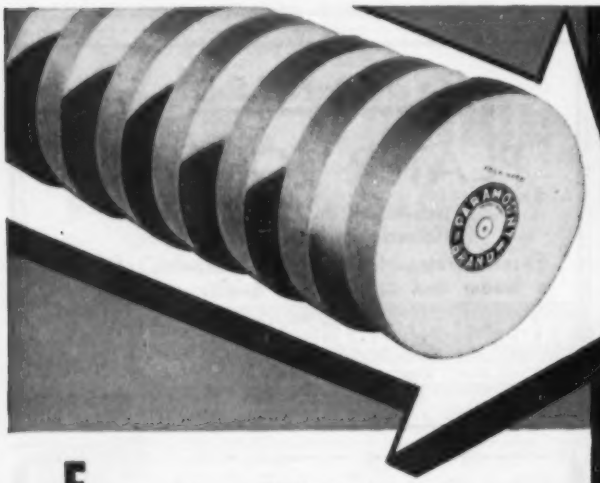
References cited: German Patents 496,972; 694,738. Studies in Electrodeposition of Metals, by Keyes et al, University of Illinois Bulletin May 20, 1930, pp. 5–10.

No. 2,651,609, September 8, 1953—Method of Electroplating Copper—A. E. Chester, assignor to Poor & Company, Chicago, Ill.

CLAIM 1. In a method of controlling the electrodeposition of copper from an acid copper sulfate plating bath onto an electrically conducting object of a type in which the copper would normally be deposited in greater concentrations in some areas than in others by a direct plating current; the step which comprises electrodepositing the copper by subjecting said object to an acid plating bath to a plating current having an asymmetric alternating wave form comprising an alternating current superimposed on a direct current in the ratio of 2–4 volts rms to 2.5 volts dc, regardless of the specific current values, at current densities from about 2 to about 15 amperes per square foot.

2 claims, 3 figures, 1 example.

References cited: U. S. Patents 1,918,605; 2,063,760; 2,443,599; 2,515,192. Transactions of the Faraday Society, Vol. 24 (1928), pp. 348–358; Vol. 18 (1922), pp. 102–111. American Electroplaters' Society Monthly Review, February, 1944, p. 168. Transaction of the American Electrochemical Society, Vol. 41 (1922), pp. 151–180.



PARAMOUNT BRAND

FELT WHEELS ...TOPS IN Durability

Even the softest of Felt Wheels offers a durability difficult to match with any other of the commonly used fabric materials. Not only is felt tough and resistant to wear but when wear does occur, the wheel can be re-faced or re-contoured.

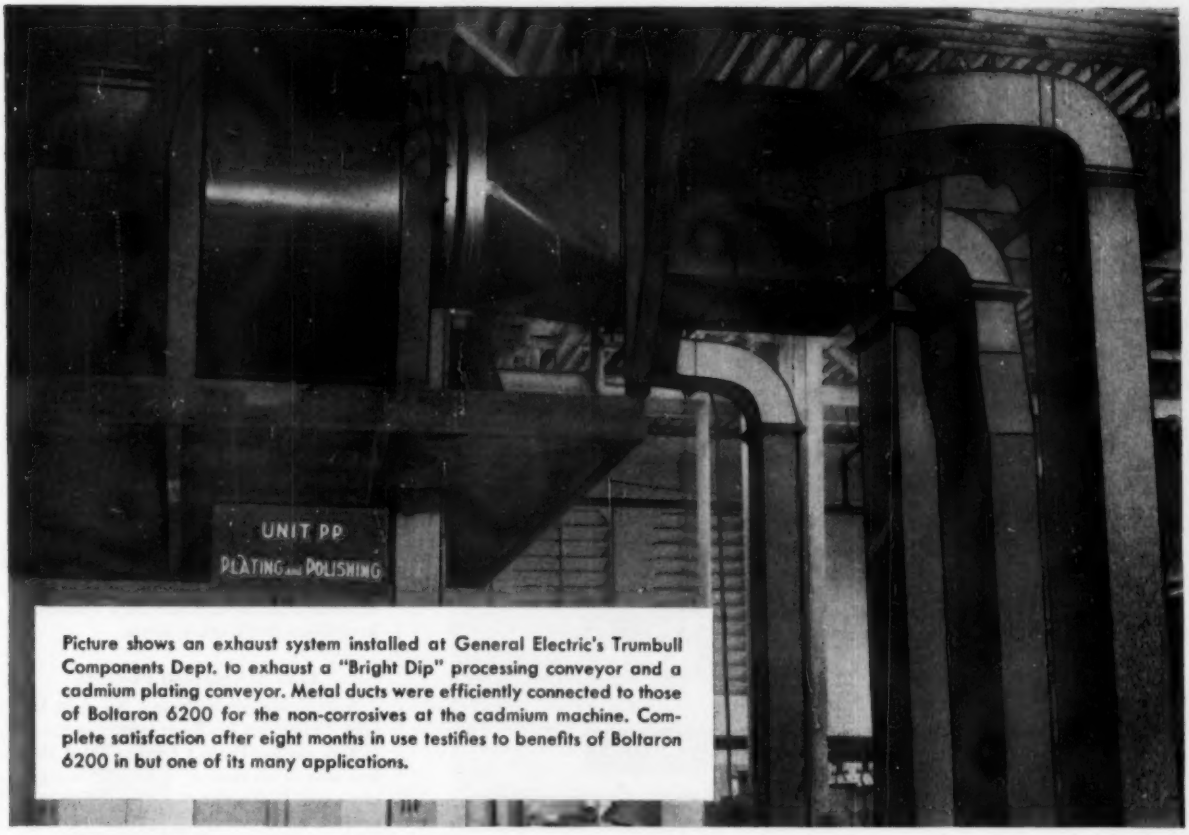
The net result of this durability is longer wheel life—longer *useful* wheel life. Try a Paramount Brand Felt Wheel of the proper hardness competitively. Check it against other wheels. We are confident it will show you greater earnings as measured by finished articles per wheel life.

BACON FELT COMPANY

407 West Water Street Founded 1825 Taunton, Massachusetts

"America's Oldest Felt Manufacturer" "Felt Does It Better"

Your Supply House can Furnish Bacon PARAMOUNT BRAND FELT BOBS & WHEELS



Picture shows an exhaust system installed at General Electric's Trumbull Components Dept. to exhaust a "Bright Dip" processing conveyor and a cadmium plating conveyor. Metal ducts were efficiently connected to those of Boltaron 6200 for the non-corrosives at the cadmium machine. Complete satisfaction after eight months in use testifies to benefits of Boltaron 6200 in but one of its many applications.

PLANT LAYOUT SUPERVISOR REPORTS COMPLETE SUCCESS WITH *Boltaron* 6200

Unplasticized Polyvinyl Chloride

"A definite answer to replacement and maintenance problems on exhaust ducts and hoods for caustic or corrosive solutions," says Mr. G. R. Buys.

PLAINVILLE, CONN. In an eight-month performance report at the Trumbull Components Department of the General Electric Company here on this new unplasticized polyvinyl chloride, it was revealed that Boltaron 6200 has given "no evidence of breakdown or breakage due to rough treatment, while living up to every expectation." Completely corrosive-resistant and readily adaptable to hundreds of industrial and chemical uses, Boltaron 6200 continues to win wide acceptance and enthusiastic approval in plants across the country.

Boltaron 6200 is manufactured in the United States and is available in the following forms: *sheets* — size 30" x 60" (approximately), in thicknesses from 1/32" to 1"; *rod stock* — (10' lengths) 1/4 to 2"; *pipe* — (10' and 20' lengths) 1/8" to 4"; *fittings* and *valves* — standard, threaded I.P.S. sizes of 1/8", 1/4", 3/8", 1/2", 3/4", 1", 1 1/4", 1 1/2", and 2".

Whether your problem is in electroplating, anodizing or other chemical processing, investigate *first* the many advantages of Boltaron 6200. For more information and laboratory test results, write us direct.

H. N. HARTWELL & SON, INC.

Industrial Plastics Division, Park Square Building, Boston 16, Massachusetts

Licensed fabricators and agents located in Boston, Mass.; Buffalo, N. Y.; Winston-Salem, N. C.; Hawthorne, N. J.; Knoxville, Tenn.; Byesville, Ohio; Owosso, Mich.; Minneapolis, Minn.; Fort Worth, Texas; Los Angeles, Cal.; Seattle, Wash.; Pittsburgh, Pa.; Wilmington, Del.

BE SURE TO SEE BOLTARON 6200 AT THE CHEMICAL SHOW NOV. 30 — DEC. 5

There's still a NICKEL SHORTAGE! — BUT

Now you can have bright, attractive, wear-resistant chromium plated finishes *WITHOUT THE USE OF NICKEL*

LUSTER-ON® ZINCROME® PROCESS*

provides *excellent corrosion resistance* — up to 50 hours standard salt spray

LUSTER-ON ZINCROME PROCESS

provides *good wear resistance* — the hardness of chrome plate needed for tools, bumpers, etc.

LUSTER-ON ZINCROME PROCESS

provides *accepted brilliant finish* — for outside wear exposure required for automotive trim, etc.

LUSTER-ON ZINCROME PROCESS

provides *economical operation* — high, rugged quality at lowest possible operating cost

LUSTER-ON ZINCROME PROCESS

provides a *precisely controlled "package" process* — 10 easy-to-follow, easy-to-use steps

Specify

LUSTER-ON • ZINCROME • PROCESS

FOR CHROMIUM PLATED FINISHES WITHOUT THE USE OF NICKEL

Write for free data sheets and send a part for free processing

*Patent applied for

THE *Chemical* CORPORATION

57 WALTHAM AVENUE SPRINGFIELD 9, MASS.

A.E.S. News

Executive Board Meets

The Executive Board met in New York City at the Statler Hotel on October 3–4, 1953. During the two-day meeting, General Chairman George Shore of the 1954 Convention group presented a progress report on the July National Meeting—stating during his report that the affair would be "as fine a Convention as was ever held".

A.E.S. Research Committee Meets

The Society's Research Committee met at Headquarters on September 24, 1953.

During the session there was some discussion of Branch Research Chairman activity. It was the general feeling of the group that a suggestion be made that each Branch Second Vice-President should be responsible for research and thus should be designated Branch Research Chairman in addition to his other duties.

A. E. S. Research Projects

A. E. S. Research Project No. 2 at Lehigh University has been reactivated. As of this writing Project Director E. J. Serfass also is serving as "acting" associate until one is appointed. The reactivated project will cover the study and development of efficient methods of analysis for major constituents in plating baths and auxiliary solutions.

Mrs. Margaret Hilkert has been appointed research associate for Project No. 13 at the National Bureau of Standards under the direction of Fielding Ogburn.

Committee Appointments

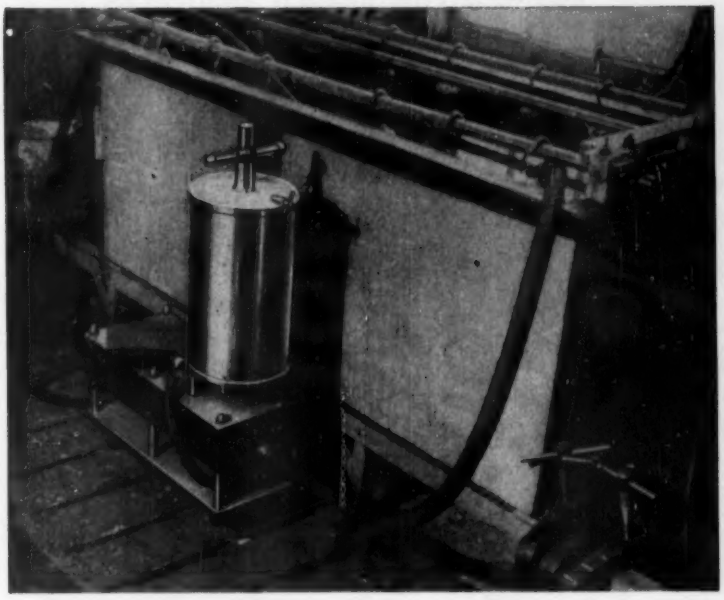
President G. P. Swift announced the appointment of members to the Committee on Broadening the Scope of the Society. The committee, under the chairmanship of Second Vice-President Clyde Kelly: D. G. Foulke, Hanson-Van Winkle-Munning Company; H. E. Head, Briggs Manufacturing Company; K. M. Huston, Armco Steel Corporation; S. S. Johnston, Weirton Steel Company; R. F. Ledford, Industrial Filter and Pump Manufacturing Company; Frank G. Miller, Cincinnati; and R. A. Parker, Bridgeport, Conn.

Also announced were the appointments to the Paper Awards Committee as follows: Frank Eddy, Chairman, Chase Brass & Copper Company; Martin J. Maher, Oakite Products, Inc.; and William H. Safranek, Battelle Memorial Institute.

A. E. S. Research Committee Chairman E. J. Serfass announced the appointment of Dr. Abner Brenner as Chairman of the Committee on Quantitative Measuring Instruments for Electroplating. The remainder of the committee will be named at a future date.

Here's how to cut your losses

get better finished plated work — save time and labor



The "Sealed-Disc" Filter will remove all dirt, dust, and sludge from your plating solutions. You'll no longer worry about pitting, spotting, poor adhesion, formation of nodules, etc.

More and more platers testify to the remarkable savings in operating time and labor that the "Sealed-Disc" Filter gives them. These cost-minded platers get better finished plated work and have found that their solutions last longer. "Sealed-Disc" Filters, designed to meet plating room requirements, are smaller, more compact and portable, than ordinary conventional filters.

Regardless of the size or type of your installation, there's a "Sealed-Disc" Filter to "fit your job." You can depend on a "Sealed-Disc" Filter for positive, trouble-free performance that's proof against even the invisible impurities that cause nodules and porousness, proof against losses caused by rejects and reworking. Write for complete details or contact your regular plating supplier.

ALSOP
ENGINEERING CORPORATION
811 Fine Street — Milldale, Connecticut

Other Alsop Plating Room Equipment

We manufacture a full line of Mixers and Agitators covering a complete range of sizes, for mixing, blending, and dissolving. Stainless Steel Mixing Tanks are also available in a wide range of capacities. For full details and illustrations write for your free catalog.

A.E.S. INTERIM MEETING, ROYAL YORK HOTEL,
Toronto, Ontario, February 13, 1954.

Delegates should make their own hotel reservations. Hotel officials advise that this be done no later than December 15, 1953.

GRAND RAPIDS BRANCH ANNOUNCES

QUADRUPLETS You Are Invited

to meet them at their first public appearance, Saturday, January 23, 1954. Four brand-new papers will be presented at the Eleventh Annual Educational Session of the Grand Rapids Branch, starting at 1:30 P. M. *sharp*. Officiating as Chairman will be Clyde Kelly, 2nd Vice-President of the Supreme Society. The Speakers and their topics are:

1. "The Next Fifty Years—A Glimpse of the Future on the 50th Anniversary of Powered Flight", B. K. Stevens, Staff Engineer on Special Projects, Lear, Inc., Grand Rapids, Mich.
2. "Production Cleaning and Preparation of Metal Surfaces for Organic Coatings", C. W. Smith, President, Whitfield Chemical Co., Inc., Detroit, Mich.
3. "Technology of Liquid Buffing Compositions", Robert V. Twyning, Twyning Chemical Specialties Co., Belvidere, Ill.
4. Title to be Announced, Dr. R. A. Schaefer, 1st Vice-President, A.E.S. Director of Research, Cleveland Graphite Bronze Co., Cleveland, Ohio

In the evening, the very popular Dinner-Dance will begin at 7 P. M. Tickets go on sale Monday, December 7. Orders for tickets are filled from this date on strictly in the order in which checks are received. The price is $10 per plate, and there are ten seats per table. Facilities available limit the number of tables to 47. The ticket chairman is Mr. J. J. Hanney, 129 Arthur N. E., Grand Rapids, Mich.

Coming Event

PHILADELPHIA BRANCH

ANNUAL EDUCATIONAL SESSION AND DINNER-DANCE

Saturday, November 21, 1953
Broadwood Hotel, Philadelphia, Pa.

PAPERS AND SPEAKERS

E. G. SCHROEDER, Electric Products Co., Cleveland, Ohio, "Application, Use and Maintenance of Motor-Generator Sets and Rectifiers for the Electrolytic Processes"

MILTON NADEL, Berkeley Industries, Jersey City, N. J.: "Defects in Plating Solutions and Their Remedies"

DR. R. A. SCHAEFER, Clevite-Brush Development Co., Div. of the Clevite Corp., Cleveland, Ohio, "Cathode Forms and Their Effect on Metal Distribution"

Branch News

BUFFALO BRANCH

At the September meeting, RICHARD LAMBDON of the Kanigen Division of General American Transportation Corp. gave a talk on "Immersion Nickel Plating by the Kanigen Process".

Between 70 and 80 were present at the meeting. The talk was exceptionally interesting and was followed by a spirited question and answer session.

ERIC G. SAMPSON, JR., *Secretary*

CHICAGO BRANCH

All the big fish were caught. If you don't believe it, you should have been at Chicago Branch meeting on September 11. Some 100 members gathered to relate their summer vacation experiences and begin a new season of A. E. S. activity. As we said before, all the big fish are caught!

After cocktails and dinner, the group assembled in the auditorium to hear H. A. GILBERTSON, past national president, honorary life member and "The Order of the Pot", recount many interesting and amusing experiences acquired during a lifetime of activity in the electroplating industry.

The art of plating is at least 3000 years old. Mr. Gilbertson told about the discovery in an Egyptian excavation of a cosmetic container made of silver with a 9 kt gold plate. Historians estimated this article had been in use approximately 1000 years before the birth of Christ. Let's have no more comments about electroplating, the infant industry.

PAUL GLAB is busy with plans for a revised branch membership directory. You will receive shortly an inquiry card requesting information on company association, residence and position which should be filled out carefully and returned promptly. The value of a membership directory cannot be overestimated. Let's help Paul get this job done in record time.

An announcement of a contest awarding a scholarship prize in J. B. Kushner's electroplating correspondence course evinced considerable interest. All you have to do is write a 250-word paper on "What I Like and Dislike About the Electroplating Industry". We intend to write Mr. Kushner requesting permission to read some of the entries. We aren't aware of any "dislike" for electroplating

SEYMOUR

NICKEL ANODES

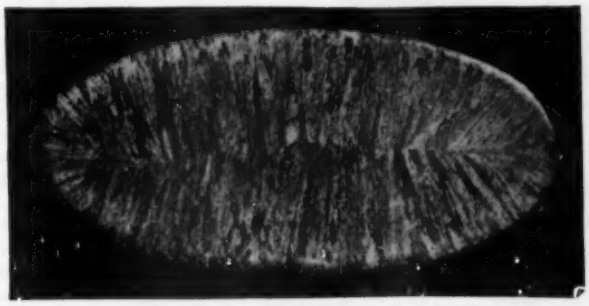
GRAINS THAT INTERLOCK

The Effective Remedy for Intercrystalline Corrosion

LOOSE nickel in high acid or low pH baths results from intercrystalline corrosion, which isolates the grains before they have a chance to dissolve. This is practically eliminated in our "Seycast" 99%+ Pure Cast Nickel Anodes. Here the long, narrow grains extend to a common center. (See cross-section below.) As the acid can penetrate but a short distance, the grains tend to remain in place the entire corrosion cycle.

The envelope formed during corrosion is soft, the sludge extremely small per pound of anode, the particles too large to penetrate the bag . . . assuring effective protection against rough plate in high current density baths.

Seymour "Seycast" Nickel Anodes, though designed for Bright Nickel baths, work perfectly in any hot Watts bath having a pH of 4.5 electrometric or lower. Write for further details.



THE SEYMOUR MANUFACTURING CO., SEYMOUR, CONN.

NICKEL, COPPER, BRASS, BRONZE, ZINC ANODES • BRIGHT NICKEL

Branch News

but we'd like to know about them if they do exist!

The new season started on a high note with the admission to memberships of BERT ALLEN of McGean Chemical Company and EDWARD PROSKOCIL of Koley Plating Company of Omaha, Neb. Welcome to the fold, brothers, happy to have you aboard.

PRESIDENT JOE ANDRUS appointed ED STANEK of Belke Manufacturing Company as chairman of the banquet committee for the annual Chicago Branch educational session to be held in January, 1954. Since this has been RUDY HAZUCKA's project for so many years, we can only say that we have a lofty objective to achieve. Rudy's fine work in the past leaves little hope for improvement, but we'll try hard and with Rudy's cooperation, maybe we'll come close.

Beginning with the next release, publicity chores for Chicago Branch will be handled by JERRY KUDERNA of Scientific Control Laboratories. Jerry brings the youthful slant to this picture and his ideas promise readable articles loaded with interest for all A. E. S. members.

"THEY WERE THERE" DEPARTMENT

H. A. Gilbertson brought his own cheering section—LESTER DUNBAR, E. JACOBSON, MILDRED DAVIDSON and ESTHER KING . . . heard that DOC MONAWECK has developed a British accent—result of his honeymoon trip to England and Europe . . . speaking of travelers, saw FRANK LAVITAS with MARTY WESTERGAARD . . . J. M. BONDREAU now associated with Lake Short Electrotype . . . ART KRAUSE, formerly with A. O. Smith, now working for Riverdale Metal Finishers . . . JOHN COTTONE and HENRY HUNZINGA looking tanned and refreshed . . . AL BRUMM of Kuehne Manufacturing with FRED BRYAN now with Wagner Brothers . . . BILL BARRON of Lyons Band Instrument and W. H. MURPHY of Diversey Corporation . . . MAL FOCHT and CARL LODICO of Heatbath Corporation . . . R. L. BROWN visiting for Solventol Chemical . . . and ED DEMLOW of Anchor Coupling . . . LOU LANZ looking in the pink . . . FRED HUBRICH of Bell & Howell and ED WILD of R. O. Hull . . . good to see SY GARY again . . . all in all, a distinguished gathering to start a new season of service to the electroplating industry.

EDWARD STANEK,
2nd Vice-President

CLEVELAND BRANCH

The Branch held its first meeting of the current season at the Hotel Carter on September 11. Seventy-five members and guests were present. The business meeting was opened by PRESIDENT JACK LITTLE. Three applications for membership were received and accepted. J. EMLICH gave a very favorable report on the annual outing held at the Spring Valley Golf Course at which some 300 members and guests were present. GENE COMBS reported that plans were progressing for the 1955 annual convention to be held in Cleveland.

After other routine business, a combination cocktail-round-table discussion was held. LIBRARIAN ED ROEHL introduced the panel of experts: HOWARD BLOUGH, R. HULL, CHARLIE OTT, DICK PARKS and MODERATOR LEON WESTBROOK. Lively discussions ensued covering many phases and problems in metal finishing.

A. H. DU ROSE,
Assistant Librarian

DAYTON BRANCH

The first meeting of the 1953–1954 season was held at the Biltmore Hotel on September 9. The meeting was called to order with 22 members and guests present. BOB RULEFF and FRED BAUCH reported on the National Convention.

EZRA BLOUNT of the Cincinnati Branch explained their proposal to hold a regional meeting in this area. He suggested that the Cincinnati, Columbus, Dayton, Indianapolis and Louisville Branches cooperate in this proposed meeting. After a lengthy discussion, the proposal was turned over to the Executive Board for a recommendation.

NORBERT MOLLMAN of the National Cash Register Company and AVERY WATSON of Standard-Thompson Corporation were accepted as members.

LIBRARIAN HOLLE LUECHAUER introduced WALTER RIEDEL who discussed "Unusual Patents". Mr. Riedel, who

SEL-REX builds the world's largest single cubicle Selenium Rectifiers — up to 50,000 amperes — completely sealed and water cooled for absolute protection against dust, dirt and corrosion. Large single cubicle units, that will fill any D.C. power requirement, are another engineering accomplishment of the same company which originally developed completely protected rectifiers designed to withstand highly corrosive atmosphere.

There is a Sel-Rex Selenium Rectifier for every plating purpose, from 25 to 50,000 amperes. Regardless of size or type, all of them incorporate the features that make Sel-Rex the foremost name in D.C. power — top efficiency, long life and low maintenance costs, even under the most rugged plating conditions.

BART-MESSING CORPORATION

Dept. PL-11 229 Main St. Belleville 9, N. J.

Pioneers and Builders of Time Tested COMPLETELY SEALED Plating Rectifiers

Without obligation, write for a copy of "Plating Power" or have our technical representative call to discuss your specific requirements.

STUTZ PLATING BARRELS

OF HIGH TEMPERATURE LUCITE!

for:

- Heavy Duty Production
- Highest Possible Current
- Complete Cycle—all solutions
  (temperature to 185°F)

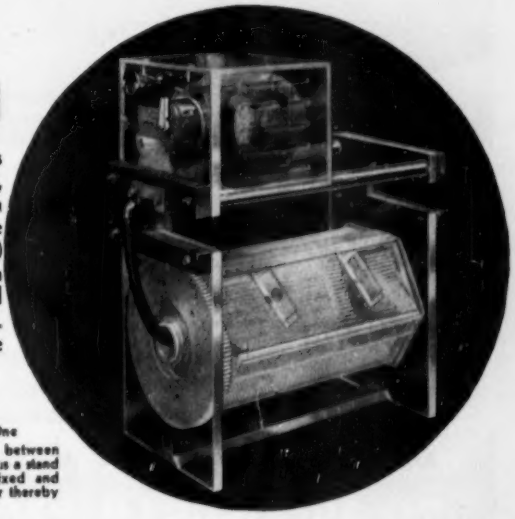
Stutz Plating Barrel Unit for continuous operation through Alkali Cleaning, Acid Pickling, Acid and Alkaline Plating solutions and rinsing. Largest number of cylinder perforations possible.

Stutz Plating Barrel Unit, Motor Drive Mounted Overhead. Continuous rotation of cylinder from one operation to another and where a minimum of solution dragout is important. Roller bearing chain drive to absorb load shock. On a complete Barrel Plating installation, this type of equipment can be made at lower cost since motor drives are not required on each tank station.

Where extremely small openings are required, our patented Dual Hole is used. This design permits solution flow with a minimum of resistance.

The Stutz Portable Plating Barrel

The Stutz Portable Plating Barrel—designed to provide continuous processing of piece parts through the operations of Alkali Cleaning, Water Rinsing, Acid Treatment and Plating. Progression through these operations is made by manual handling or if necessary with the assist of an overhead traveling hoist. (Hoist attachment available.) The Stutz Portable Plating Barrel is made in 2 standard sizes with cylinders having inside dimensions of 6" x 12" and 8" x 18". Special sizes smaller or larger, and with partitions if necessary can be provided. Standard perforations are 3/32" or larger. Smaller openings can be furnished as required. Operating temperature up to 185° F.



Write for our new Illustrated Literature Showing This and Other Design Arrangements.

Specify whether interested in portable or large unit.

Illustrated: Design Number One
Cylinder suspended and rotated between heavy side frames designed to serve as a stand support. Side frames are firmly fixed and further braced with a bottom tie bar thereby providing rigid bearing stability.

GEORGE A. STUTZ Manufacturing Co., 1643 Carroll Avenue, Chicago 12, Illinois

"Complete metal finishing equipment and supplies"

was patent attorney with General Motors Corporation for 41 years, explained the procedure for obtaining patents as well as protecting patent rights. He explained that a patent gives exclusive right to manufacture, use and sell a product for seventeen years, but it does not guarantee this right. It does, however, give the right to sue against infringement. Using slides he explained the mechanics of a series of "screwy" patents dating back as far as 1791. He pointed out that a pteant cannot be renewed beyond the seventeen years but an improvement can be obtained on the original patent. Although the talk did not deal with electroplating, those present found it amusing and informative, and thought it one of the best meetings they have attended in several years.

The meeting was followed by a social hour sponsored by Ruco, Inc., Dayton, Ohio with Ray Coy, Bob Ruleff and Frank Klein acting as hosts.

John K. Easton, *Secretary*

DETROIT BRANCH

President L. C. Borchert called the first meeting of the 1953–1954 season to order at 8:15 P. M. in the Michigan Room of the Hotel Statler, with approximately 150 members and guests present.

James Fretz, James Gordon and Richard Wisniewski are newly elected members to the society.

Reports from the committees were as follows:

Stag Day—Chairman A. J. Emmerich reported that there were 943 tickets sold, an increase of about 15 per cent from the previous year. Seven hundred and eighty-seven members and guests attended the dinner, with 369 golfers playing an interesting course at Glen Oaks Country Club.

Membership Committee—Chairman Joe Gurski reported that membership is above the 500 mark and that everyone should consider themselves a part of the committee to keep membership at its present level.

Reports from the Delegates at the 1953 National Convention—Reported by Cleve Nixon and Frank Clifton, the 1953 National Convention met at the Benjamin Franklin Hotel in Philadelphia.

The new delegates for the 1953 Interim Meeting at Toronto and 1954 National Convention are Cleve Nixon, Herb Head and Joe Gurski.

Educational Committee—After the showing of color movie, "Pheasants Galore", an interesting story of ring-necked pheasant hunts in South Dakota, Chairman Fred Olmsteadt introduced Dr. Henry Brown, Research Director, Udylite Corporation.

Dr. Brown gave excerpts from a technical report presented at Philadelphia and published in the August issue of Plating.

A question and answer period followed. The meeting was adjourned at 10 P. M.

Fellowship continued after the meeting with the serving of beer and pretzels.

John C. Drinkwater,
Publicity Chairman

HARTFORD BRANCH

The first regular Branch meeting of the year was held at the Bond Hotel on September 21 with 65 members and guests present. Preceding the meeting a color movie, entitled "Harnessed Lightning, the Story of Jet Engines", was presented. Following this Mr. G. B. Hogaboom spoke briefly on the latest developments in the electroplating field.

Guest speaker for the evening was John E. Cutcliffe, Process Engineer, Tainton Co., Baltimore, Md., whose subject was "Peen Plating".

Cutcliffe described the process as an electroless method for cladding metals with zinc, cadmium, brass, aluminum, titanium, tin and lead by tumbling operations in standard barrel finishing equipment. Powders of the above metals are used together with certain proprietary chemicals which enable the cladding to take place. A lively question period followed and samples of parts finished by this method were shown.

Thomas McFarlane was technical chairman for the evening.

Stanley Platoz, *Secretary*

LANCASTER BRANCH

The first meeting of the new year was held at the Lake Club, Spring Grove, Pa., September 11. Thirty-four members and guests attended.

After an enjoyable lobster-tail dinner, President John Reynolds called the meeting to order. Three applications for membership were presented.

The speaker of the evening, Clarence

Complete, Modern Facilities Assure You The Utmost in Quality and Service on

BUCKINGHAM POLISHING and BUFFING Compositions

- Stainless Steel Composition
- White Finish
- Tripoli
- Chrome Coloring Composition
- Greaseless Composition
- Emery Cake
- Brass Coloring
- Emery Paste
- Burring Compound*
- Grease Stick
- Spray Pastes Stainless Steel Tripoli

Representation in Major Cities Write Dep't. B for Samples

The BUCKINGHAM PRODUCTS Co.

14100 FULLERTON AVE. • DETROIT 27, MICH.

CHEMICALS ACP PROCESSES

PHOSPHATE COATINGS TO MAKE YOUR PRODUCT DURABLE*

PIONEERING RESEARCH AND DEVELOPMENT SINCE 1914

For more than a third of a century, ACP research chemists and ACP technical representatives in the field have pioneered in the science of metal preservation. They have developed surface treating chemicals which either protect metals directly, or create a superior bond for decorative and protective paint finishes, and now, ACP chemicals and processes are being used the world around to reduce costs, speed production and add to the life-span of countless products.

ACP metal protective chemicals include: protective coating chemicals for steel, zinc and aluminum; metal cleaners and rust removers; final rinse controls; pickling acid inhibitors; copper coating chemicals; soldering fluxes; alkali cleaners and addition agents; copper stripping and brightening solutions.

PAINT BONDING

"GRANODINE"® zinc phosphate coatings improve paint adhesion on automobiles, refrigerators, projectiles, rockets, and many other steel and iron fabricated units or components.

"LITHOFORM"® zinc phosphate coatings, make paint stick to galvanized iron and other zinc and cadmium surfaces.

"ALODINE"® protective coatings provide improved paint adhesion and high corrosion-resistance for aircraft and aircraft parts, awnings, wall tile, signs, bazookas, and many other products made of aluminum.

RUST PROOFING

"PERMADINE"® zinc phosphate coatings provide rust and corrosion proofing for nuts, bolts, screws, hardware, tools, guns, cartridge clips, and many other industrial and ordnance items.

PROTECTION FOR FRICTION SURFACES

"THERMOIL GRANODINE"® manganese-iron phosphate coatings provide both rust proofing and wear resistance — anti-galling, safe break-in, friction on rubbing parts.

IMPROVED DRAWING AND COLD FORMING

"GRANODRAW"® zinc phosphate coatings make possible improved drawing, cold forming and extrusion on such steel products as sheets for stamping, bumpers, parts to be formed, prior to plating or painting, cartridge cases, etc.

*Made, Sold, and Serviced By A Pioneer In Protective Coatings For Metals . . .

AMERICAN CHEMICAL PAINT COMPANY

General Offices: Ambler, Penna.

Detroit, Michigan — *Niles, California* — *Windsor, Ontario*

was patent attorney with General Motors Corporation for 41 years, explained the procedure for obtaining patents as well as protecting patent rights. He explained that a patent gives exclusive right to manufacture, use and sell a product for seventeen years, but it does not guarantee this right. It does, however, give the right to sue against infringement. Using slides he explained the mechanics of a series of "screwy" patents dating back as far as 1791. He pointed out that a pteant cannot be renewed beyond the seventeen years but an improvement can be obtained on the original patent. Although the talk did not deal with electroplating, those present found it amusing and informative, and thought it one of the best meetings they have attended in several years.

The meeting was followed by a social hour sponsored by Ruco, Inc., Dayton, Ohio with Ray Coy, Bob Ruleff and Frank Klein acting as hosts.

John K. Easton, *Secretary*

DETROIT BRANCH

President L. C. Borchert called the first meeting of the 1953–1954 season to order at 8:15 P. M. in the Michigan Room of the Hotel Statler, with approximately 150 members and guests present.

James Fretz, James Gordon and Richard Wisniewski are newly elected members to the society.

Reports from the committees were as follows:

Stag Day—Chairman A. J. Emmerich reported that there were 943 tickets sold, an increase of about 15 per cent from the previous year. Seven hundred and eighty-seven members and guests attended the dinner, with 369 golfers playing an interesting course at Glen Oaks Country Club.

Membership Committee—Chairman Joe Gurski reported that membership is above the 500 mark and that everyone should consider themselves a part of the committee to keep membership at its present level.

Reports from the Delegates at the 1953 National Convention—Reported by Cleve Nixon and Frank Clifton, the 1953 National Convention met at the Benjamin Franklin Hotel in Philadelphia.

The new delegates for the 1953 Interim Meeting at Toronto and 1954 National Convention are Cleve Nixon, Herb Head and Joe Gurski.

Educational Committee—After the showing of color movie, "Pheasants Galore", an interesting story of ring-necked pheasant hunts in South Dakota, Chairman Fred Olmsteadt introduced Dr. Henry Brown, Research Director, Udylite Corporation.

Dr. Brown gave excerpts from a technical report presented at Philadelphia and published in the August issue of Plating.

A question and answer period followed. The meeting was adjourned at 10 P. M.

Fellowship continued after the meeting with the serving of beer and pretzels.

John C. Drinkwater,
Publicity Chairman

HARTFORD BRANCH

The first regular Branch meeting of the year was held at the Bond Hotel on September 21 with 65 members and guests present. Preceding the meeting a color movie, entitled "Harnessed Lightning, the Story of Jet Engines", was presented. Following this Mr. G. B. Hogaboom spoke briefly on the latest developments in the electroplating field.

Guest speaker for the evening was John E. Cutcliffe, Process Engineer, Tainton Co., Baltimore, Md., whose subject was "Peen Plating".

Cutcliffe described the process as an electroless method for cladding metals with zinc, cadmium, brass, aluminum, titanium, tin and lead by tumbling operations in standard barrel finishing equipment. Powders of the above metals are used together with certain proprietary chemicals which enable the cladding to take place. A lively question period followed and samples of parts finished by this method were shown.

Thomas McFarlane was technical chairman for the evening.

Stanley Platoz, *Secretary*

LANCASTER BRANCH

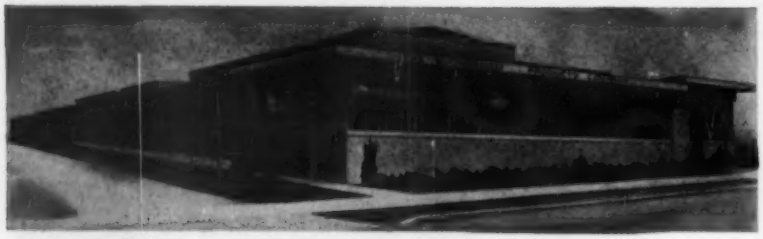
The first meeting of the new year was held at the Lake Club, Spring Grove, Pa., September 11. Thirty-four members and guests attended.

After an enjoyable lobster-tail dinner, President John Reynolds called the meeting to order. Three applications for membership were presented.

The speaker of the evening, Clarence

Complete, Modern Facilities Assure You The Utmost in Quality and Service on

BUCKINGHAM POLISHING and BUFFING Compositions



- Stainless Steel Composition
- White Finish
- Tripoli
- Chrome Coloring Composition
- Greaseless Composition
- Emery Cake
- Brass Coloring
- Emery Paste
- Burring Compound*
- Grease Stick
- Spray Pastes Stainless Steel Tripoli

Representation in Major Cities Write Dep't. B for Samples

The BUCKINGHAM PRODUCTS Co.

14100 FULLERTON AVE. • DETROIT 27, MICH.

CHEMICALS ACP PROCESSES

PHOSPHATE COATINGS TO MAKE YOUR PRODUCT DURABLE*

PIONEERING RESEARCH AND DEVELOPMENT SINCE 1914

For more than a third of a century, ACP research chemists and ACP technical representatives in the field have pioneered in the science of metal preservation. They have developed surface treating chemicals which either protect metals directly, or create a superior bond for decorative and protective paint finishes, and now, ACP chemicals and processes are being used the world around to reduce costs, speed production and add to the life-span of countless products.

ACP metal protective chemicals include: protective coating chemicals for steel, zinc and aluminum; metal cleaners and rust removers; final rinse controls; pickling acid inhibitors; copper coating chemicals; soldering fluxes; alkali cleaners and addition agents; copper stripping and brightening solutions.

PAINT BONDING

"GRANODINE"® zinc phosphate coatings improve paint adhesion on automobiles, refrigerators, projectiles, rockets, and many other steel and iron fabricated units or components.

"LITHOFORM"® zinc phosphate coatings, make paint stick to galvanized iron and other zinc and cadmium surfaces.

"ALODINE"® protective coatings provide improved paint adhesion and high corrosion-resistance for aircraft and aircraft parts, awnings, wall tile, signs, bazookas, and many other products made of aluminum.

RUST PROOFING

"PERMADINE"® zinc phosphate coatings provide rust and corrosion proofing for nuts, bolts, screws, hardware, tools, guns, cartridge clips, and many other industrial and ordnance items.

PROTECTION FOR FRICTION SURFACES

"THERMOIL GRANODINE"® manganese-iron phosphate coatings provide both rust proofing and wear resistance — anti-galling, safe break-in, friction on rubbing parts.

IMPROVED DRAWING AND COLD FORMING

"GRANODRAW"® zinc phosphate coatings make possible improved drawing, cold forming and extrusion on such steel products as sheets for stamping, bumpers, parts to be formed, prior to plating or painting, cartridge cases, etc.

Made, Sold, and Serviced By A Pioneer In Protective Coatings For Metals . . .

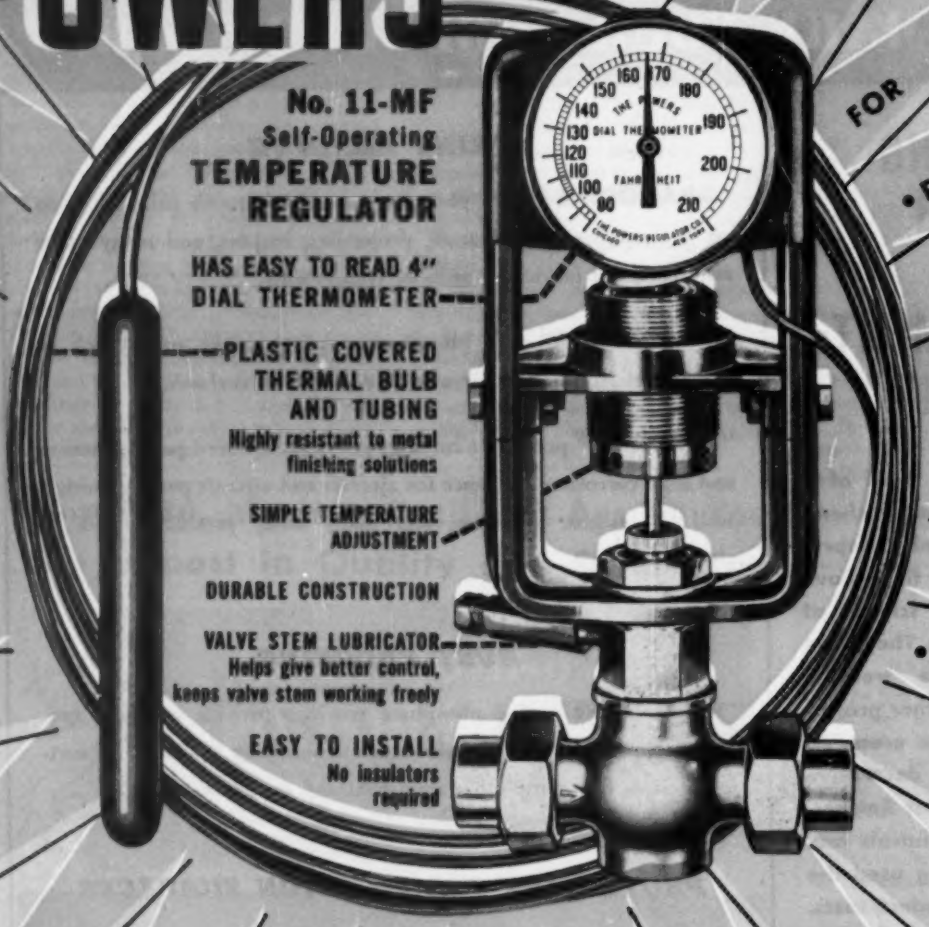
AMERICAN CHEMICAL PAINT COMPANY

General Offices: Ambler, Penna.

Detroit, Michigan — *Niles, California* — *Windsor, Ontario*

POWERS

No. 11-MF
Self-Operating
TEMPERATURE REGULATOR



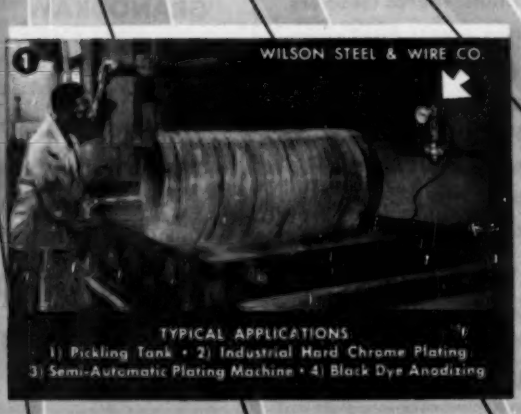
- HAS EASY TO READ 4" DIAL THERMOMETER
- PLASTIC COVERED THERMAL BULB AND TUBING — Highly resistant to metal finishing solutions
- SIMPLE TEMPERATURE ADJUSTMENT
- DURABLE CONSTRUCTION
- VALVE STEM LUBRICATOR — Helps give better control, keeps valve stem working freely
- EASY TO INSTALL — No insulators required

FOR
- PLATING
- ANODIZING
- BONDERIZING
- CLEANING
- PICKLING
- RINSE TANKS

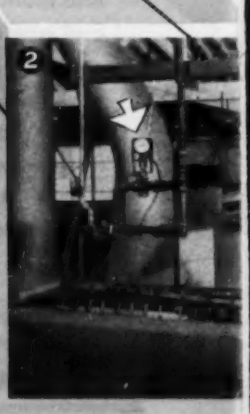
NEW! Improved!

Temperature Control
FOR METAL FINISHING PROCESSES

HOLDS TEMPERATURE WHERE YOU WANT IT . . .
STEAM SUPPLY
Helps Workers Produce a Better Product
Prevents OVER-heating • Saves Steam



TYPICAL APPLICATIONS
1) Pickling Tank • 2) Industrial Hard Chrome Plating
3) Semi-Automatic Plating Machine • 4) Black Dye Anodizing



Better Quality Plating

Saves LABOR, Material and Steam

Helps Eliminate Rejects

MOST VERSATILE REGULATOR for METAL FINISHING PROCESSES

Repays Its Cost 3 to 6 Times a Year

POWERS **NEW No. 11-MF Self-Operating Temperature REGULATOR**

Will help you get the most effective use from chemical solutions in plating, anodizing, bonderizing, cleaning, pickling and rinse tanks.

Eliminate "the human element" in temperature control with Powers automatic Regulators. They're simple, compact and dependable. They stop OVER-heating, prevent waste of steam, water wasted by evaporation, burnt plated parts, rejected anodizing, decomposition of costly additives and loss of volatile ingredients from some cleaning solutions.

Powers Regulators require no electricity, are available in several temperature ranges and valve sizes with heavy duty double union bronze body and valve stem lubricator.

Plastic Covered Thermal Bulb and Tubing are highly resistant to metal finishing solutions. Prevents electrical shorts. No insulators are required for the regulator.

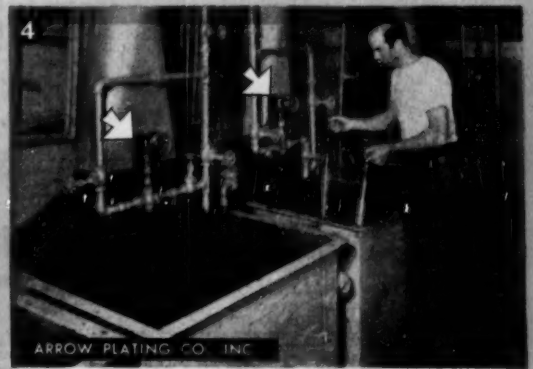
Easy to read 4" Dial Thermometer indicates temperature of solution under control. It gives a visual check of the process and makes it easy to adjust regulator for different temperatures.

Write for Bulletin 330. If you want to try a Powers No. 11-MF Regulator contact our nearest office or write us direct.

Prompt Delivery from Stocks in Leading Plating Centers.

Established in 1891 • THE POWERS REGULATOR COMPANY • SKOKIE, ILL. • Offices in Over 50 Cities
in the U.S.A., CANADA and MEXICO • See Your Phone Book (h33)

BELMONT PLATING WORKS, INC.



ARROW PLATING CO., INC.

Branch News

BOERCKEL, Sales Representative of Reynolds-Robson Supply Company, was introduced.

Boerckel spoke on "Barrel Plating". In his talk, he stressed the importance of the proper size of the barrel (preferably 12 to 14 inches in diameter) as well as the most advantageous loads to put in the barrel. In order to calculate proper costs of plating as well as obtain the proper plate, the surface area rather than the volume or weight should be calculated. The following general rules were given: (1) Never overload the barrel; the proper load being slightly less than half full. (2) The larger the parts the slower the speed of the barrel. (3) The smaller the parts the faster the speed of the barrel. The speaker then showed a movie which illustrated the points he had stressed.

HARRY A. SAYLOR, *Secretary*

LOS ANGELES BRANCH

LIBRARIAN GEORGE MAGUEREAN arranged for a tour of the Kaiser Steel Corporation July 9, in Fontana. One hundred and twenty-five members and guests enjoyed the tour, which they found very interesting.

The annual picnic was held at South Gate Park, August 22, the highlights of the day being the kids' games and Platers vs. Suppliers ball game, in which the Platers suffered their first defeat in years.

A regular monthly meeting was held at the Rodger Young Auditorium, September 8, with approximately 73 members and guests present. FIRST VICE-PRESIDENT G. STUART KRENTEL announced a contest with first and second prizes for the members who brought in the most new applicants for membership. Rules are listed in the September meeting notice. The meeting was turned over to Librarian George Maguerean, who introduced J. B. MORRAY, representative for the International Nickel Corporation, who showed a color film entitled "Corrosion in Action".

The meeting was adjourned at 10:15 P. M.

L. TRUMAN STONER, *Secretary*

LOUISVILLE BRANCH

A regular monthly meeting was held May 21, at Korfhages Restaurant, with a dinner served at 6:30 P. M. PRESIDENT P. H. PATE opened the business and open meeting at 8:00 P. M. with 26 members and guests present.

President P. H. Pate presented to PAST PRESIDENT ARTHUR A. OERTEL a past president's button in honor of his excellent service as President of the Louisville Branch during the fiscal year, 1952–1953.

WILLIAM MOOSER, NORMAN W. JOHNSON and LINFORD L. JONES gave notice of their resignation from the Society.

The meeting was turned over to EDUCATIONAL CHAIRMAN STANLEY J. BEYER who, after a brief talk, introduced EDWARD WILD, Field Engineer, R. O. Hull Company, Rocky River, Ohio, as the speaker of the evening. Wild spoke on the subject of "Practical Uses of the Hull Cell", which may be summarized as follows:

1. In using the Hull cell and panels in the laboratory of a nickel solution, the concentration of metal, impurities and temperature must be the same as in the production bath to determine the adjustment of the nickel solution.
2. Amperage used on the production line in plating is important for analysis and checking of the nickel bath.
3. Carbon treatment and filtration is very important and necessary to remove impurities in the plating bath.
4. Running a Hull Cell Test will more or less give you the analysis of your difficulty in your plating solutions.
5. Hull Cell Tests can be run through the automatic plating machines with ease to determine the deficiencies and difficulties encountered in your plating solutions.
6. Tests can be made with the Hull Cell on the following solutions such as copper, cadmium, brass, silver using different kinds of panels to suit the solutions.

Slides were shown and narrated by Mr. Wild.

Considerable discussion followed and Mr. Wild was given a rising vote of thanks for a very interesting talk.

SAVE BUFFS, LABOR COMPOUND

with NANKERVIS *automatic* COMPOUND APPLICATORS

Completely automatic application of buffing compound using a Nankervis applicator saves in every step of the operation—buffs (proper head of compound), labor (no wheel tender's time), compound (no waste). And, you cut down rejects as well!

Just look at these features of the Nankervis Automatic Applicator!

- **Easy to install—from any angle.**
- **Dirtproof—all moving parts enclosed.**
- **Lightweight—ideal for floating heads.**
- **Adjustable feed rate—variable from .0015 to .015 per strike.**
- **Accommodates cakes up to 24" long.**
- **Operates on 110v single phase, 220 or 440v three phase.**

And, remember, automatic application of bar compound is cleaner, too. Send for Bulletin M-14, today.

GEORGE L. NANKERVIS COMPANY

metal-finishing equipment

19255 W. Davison Avenue • Detroit 23, Michigan

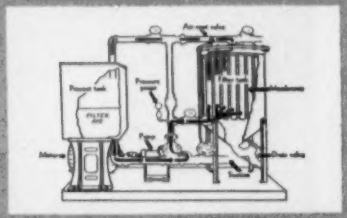
NOW–

New WAGNER Titeflex Filters end your filtering headaches

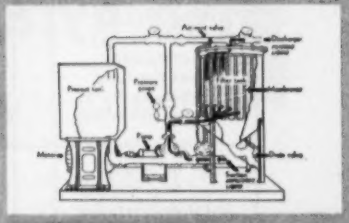
The outstanding simplicity and efficiency of Titeflex Filters are now backed up by the manufacturing facilities and electroplating experience of Wagner Brothers, Inc. Our acquisition of this leader in the filtering field means you now have Titeflex' faster cleaning, high flow rate and low operating cost *plus* the on-the-spot service of the Wagner Brothers organization in principal industrial areas.

Removal of sludge and other impurities (down to 1/10 micron) which are injurious to your plating quality is a cinch with Titeflex filters. Titeflex pumps the bath or cleaner through permanent membranes caked with a few cents worth of a filtering aid (diatomaceous earth). To clean, you turn a few valves and reverse the flow. There's no replacement, no manual cleaning labor, no dismantling. Your loss of filtering time is a matter of *minutes*. And the filtering operation requires fewer hours of inexperienced labor than any other equipment of comparable filtering efficiency.

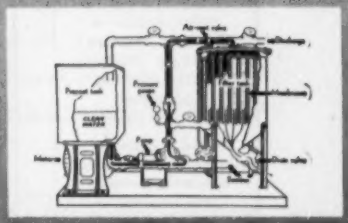
The complete standard line of Wagner-Titeflex Filters offers capacities from 1000 G.P.H. up, filter areas from 3 to 70 sq. ft.; special equipment designed and built to suit your requirements. Mail coupon on your letterhead for detailed information and filtering questionnaire. If you're a plating equipment distributor, ask about territories open.



PRECOATING: Coke of low-cost filter-aid is built up in minutes on exterior of cylinder membranes.



FILTERING: Sediment is deposited on layer of filter-aid, clear solution discharged from upper end of membranes.



CLEANING: Coke is cracked off by back-washing, broken up by built-in spray and drained off. No manual removal of residue.

Titeflex

Wagner BROTHERS INC.

DETROIT 3, MICHIGAN

CHICAGO ROCHESTER CLEVELAND

CINCINNATI INDIANAPOLIS

WAGNER BROTHERS, INC. 425 Midland, Detroit 3

- ☐ Please send complete literature regarding Titeflex Filters.
- ☐ Have sales engineer call.
- ☐ We are interested in a Titeflex Filter distributorship.

Name_____ Title_____

Company_____

Address_____

City_____ Zone____ State_____

Branch News

Refreshments were served, courtesy of MARVIN STEUERNAGEL of the Ardco Company, Chicago, Ill.

Meeting adjourned at 10:30 P. M.

JOSEPH G. STERLING,
Secretary-Treasurer

MELBOURNE BRANCH

The 81st regular meeting was held on September 17 at Melbourne Technical College, with PRESIDENT G. WALKER and 35 members and visitors present.

After acceptance of two new members, the speaker for the evening, DR. E. B. GREENHILL, was introduced.

Dr. Greenhill's subject, "Theory and Use of Wetting Agents", was opened with an explanation of basic principles of "wetting" effect of surface activator. Three factors: (1) anionic, (2) cationic, (3) nonionic were illustrated. Dr. Greenhill spoke of wetting as an emulsifying agent, also suspending and rinsability agent.

After various questions were put to the speaker, H. MERTON proposed a vote of thanks to Dr. Greenhill.

Meeting closed at 9:45 P. M.

S. B. PEARCE, *Secretary-Treasurer*

MILWAUKEE BRANCH

The kick-off meeting for the 1953–1954 season, honoring the members in the Sheboygen-Kohler area, was held on September 11, at Marty's Flamingo Club, just north of Sheboygen, Wis. The committee consisting of A. SCHMIDT, J. BORN, C. FINCH, J. MOYES, and E. ROBINSON planned a cocktail hour and a wonderful buffet luncheon, sponsored by the suppliers in this area, preceding the meeting.

PRESIDENT F. ANDERSON opened the meeting with 86 members present. SECRETARY E. PIELLUSCH read the comments of P. PETER KOVATIS, Secretary of the National Society, regarding the Branch's monthly publication, *Newsleaf*. He expressed a desire to see more of these fine letters.

Five applicants, as well as one transfer member, were accepted.

LIBRARIAN J. SCHNEIDER announced the tentative speakers for the monthly meetings through the coming year. The emphasis, he reported, would be on organic finishes over plated surfaces.

The membership was honored to hear CLYDE KELLEY, Second Vice-President of the National Society, speak on the subject of expanding the Society so as to include all phases of metal finishing, such as polishing, buffing, painting, anodizing, metallizing, etc. This trend, Mr. Kelley stated, would also be borne out in the publication PLATING, and he also stated that suggestions to the Executive Board were welcome.

The Aluminum Goods Manufacturing Company donated an electric coffee maker as a door prize, which was won by O. WINFIELD.

After the announcement that movies on corrosion would be shown through the courtesy of the Allegheny Ludlum Steel Company, the meeting was adjourned.

C. PETER, *Assistant Secretary*

PROVIDENCE-ATTLEBORO BRANCH

The Branch held the first meeting of the 1953–1954 season at the Providence Engineering Society Building, on September 21. PRESIDENT GEORGE GIBBS opened the meeting at 8:15 P. M. and after a short business meeting, the guest speaker for the evening, RUSSELL V. VANDEN BERG, was introduced.

His talk was divided into two parts: (1) Electroplating of Aluminum, and (2) Anodizing of Aluminum. The speaker went into great length in describing the methods and solutions used in the aluminum field.

The talk was very technical and the slides that were used brought out points in question very easily.

As to be expected, a very lengthy question and answer period followed. The meeting adjourned at 10:30 P. M. with 47 members and guests present.

Prior to the meeting supper was served at the Wayland Manor in Providence with 20 members and guests present.

HENRY SHAVIER, *Secretary*

ROCHESTER BRANCH

Thirty-five members and guests met on September 21 at the 40 and 8 Club to start off the fall-winter sessions. It was an interesting meeting with the topic for discussion being "Electroless Nickel".

YES
NO
Is It Safe For the Metal or Metals You Clean? (No Attack on the Metal)
Does It Clean Chemically as well as Electrolytically? (Speeding and improving the cleaning operation)
Can Its Solutions Carry High Current Densities? (Insuring fast, effective cleaning)
Can It Be Used for Either Anodic or Cathodic Cleaning? (Providing flexibility in the cleaning operation)
Does It Provide Long-Lived Solutions? (Assuring material improvement in cleaning costs)

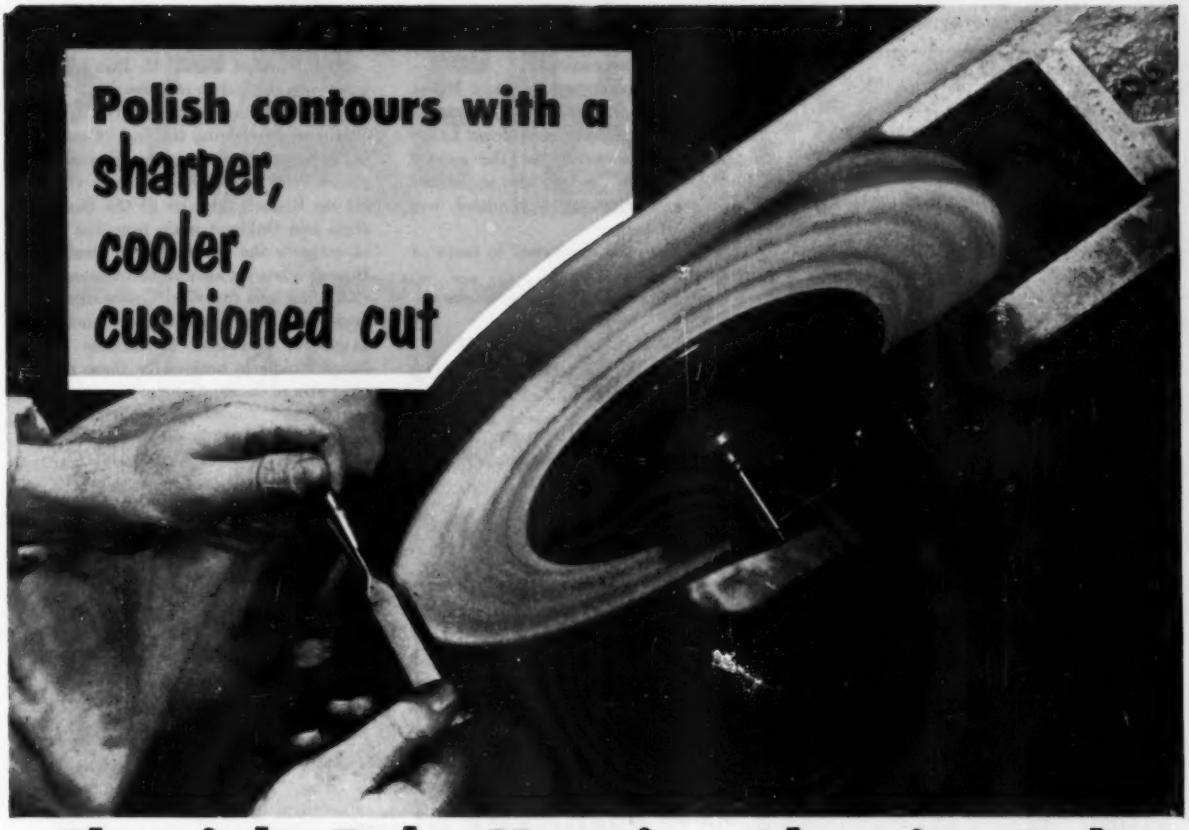
You can check every "YES" for the Right Magnus Electro-Cleaner!

There's a cleaner in the Magnus line of Electro-Cleaners best qualified to give you fast, thorough, low-cost electro-cleaning on aluminum, die-cast, steel or soft metal parts.

Ask for details on test-runs for YOUR products in the Magnus Laboratory to determine the right cleaner for your electro-cleaning operations.

magnus

MAGNUS CHEMICAL CO., INC.
41 South Avenue, Garwood, N. J.
In Canada—Magnus Chemicals, Ltd., Montreal
Service Representatives in Principal Cities



The right Behr-Manning Abrasive Belt

HAVE YOU READ THESE POLISHING BULLETINS?

"HOW POLISHER PETE PUT ECONOMY IN POLISHING" contains up-to-the-minute data on belt selection, etc.

"BLUEPRINTS FOR BETTER, FASTER PRODUCTION" contains case histories of contour polishing and other "tough" abrasive finishing jobs. Write for both copies today. Address Behr-Manning Corp., Troy, N. Y., Dept. PL-11

with a contact wheel that's right for the job — often specially formed and resilient—makes a world of difference in contour polishing output and costs. It produces a smoother, cleaner polished surface without wild grain marks and without the fuss and bother of frequent wheel changes or rework. It's the modern streamlined way that helps operators produce more with less fatigue. Check into Abrasive Belt Contour Polishing. Call in your local BEHR-MANNING® Field Engineer today.

In Canada: Behr-Manning (Canada) Ltd., Brantford.
For Export: Norton Behr-Manning Overseas Inc., New Rochelle, N.Y., U.S.A.

BEHR-MANNING®

BEHR-MANNING CORPORATION
division of NORTON Company

▲ COATED ABRASIVES
▲ SHARPENING STONES
▲ PRESSURE-SENSITIVE TAPES

Branch News

Acting as moderator for the discussion was BILL TUCKER of Eastman Kodak Company. Bill recounted some of the history and development of the process and pointed out that it showed particular advantages on jobs where nickel plating could not be done readily by conventional means. He also divulged portions of his experiences with the process and displayed some sample plated parts in answering questions as part of the general discussion.

In the business meeting prior to the discussion, the following new members were welcomed into membership in the Branch: THOMAS R. CRAIG, ORRIN B. WEBBER, JR., and CARL GREENE. The reinstatement of FRANK BEUCKMAN and resignations of W. HAWLEY and R. C. MCGLENN were announced.

A committee composed of DON BLUM, VERN SCHAEFFER and RAY BERGHOLD was appointed by PRESIDENT JOHN LENZI to handle arrangements for the annual Branch Christmas Party. Also appointed as a one-man Housing Committee was ROSWELL MINARD.

The meeting was adjourned in favor of refreshments at 10:15.

ED WALLIN, *Secretary*

SAN FRANCISCO BRANCH

A meeting was held at El Curtola Restaurant, Oakland, on August 13. In the absence of both the President and First Vice-President, SECOND VICE-PRESIDENT GEORGE LEGHORN called the meeting to order.

The scheduled speaker, B. I. TRYGSTAD, was unable to attend.

ART KING of the L. H. Butcher Company was elected to membership.

A letter from the Executive Secretary was read concerning the cost of establishing a Branch library, and a discussion followed, with the members finally voting to set up Branch libraries at the San Francisco and Oakland main branches and to investigate the possibility of establishing Branch libraries also at the University of California and Stanford University. The Secretary was requested to contact all members, and also to include in the Branch bulletin notices for three months, requesting contributions of PLATING Magazine and "Annual Proceedings of the American Electroplaters' Society".

The letter from SUPREME PAST PRESIDENT FRANKLYN J. MACSTOKER, to the President of the United States in regard to the dismissal of DR. ALLAN V. ASTIN and his subsequent reinstatement, was read to the members. Congressman from this area as compiled by the Secretary was read to the members.

HORACE J. SMITH, *Secretary*

SYDNEY BRANCH

Twenty-five members and visitors attended the 95th general meeting held at the Trust Building, Sydney, and were entertained by a film night. Included in this programme was the showing of the film "Manufacture and Plating of Zinc Base Die Castings". This film was shown at the A. E. S. first Australian Convention and this was its first showing in Sydney. The plating of zinc base die castings is a problem to many and those who attended gleaned helpful information from this film.

Other films shown were: "Faraday", "Pipeline to the Clouds", "Magic of Fluorescence".

L. F. GOLDSMITH and L. A. LIDDELL are the first two to receive the A.E.S. prize presented to the two top students passing the electroplating course at the University of Technology, and it is hoped that they will now take an active part in the Society.

B. BRIDGEMENT
Secretary-Treasurer

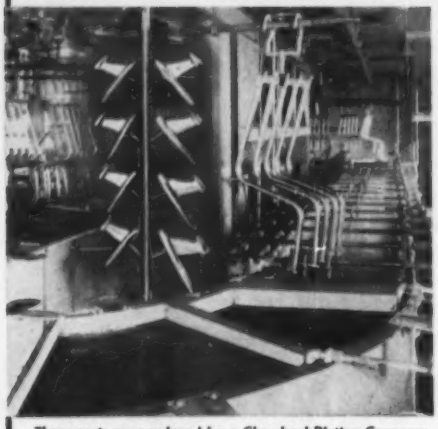
TORONTO BRANCH

Following is the annual report of the Branch elections for the fiscal year 1953–1954:

President—B. J. CAMERON
First Vice-President—G. C. MACDONALD
Second Vice-President—J. MCROBERTS
Secretary—R. L. EDWARDS
Treasurer—T. BLANDY
Librarian—E. HUTT
Board of Managers—A. SEVERS, H. DYER, DICK HAYWOOD

R. L. EDWARDS, *Secretary*

Raise Your Plating Production



These parts are produced by a Cleveland Plating Company who testifies that they have increased their production 60%.

UP TO 60%
with the NEW SMOOTHEX
BRIGHT COPPER PROCESS*

This revolutionary, new, high-speed process is your answer to an easier controlled, faster, more economical bright copper plating method in both large scale or average job shop production. Plating specialists developed the SMOOTHEX process to help you achieve top quality more profitable plating solutions capable of increasing your production 30 to 60 per cent by using your present equipment. Your operating expenses go down, too!

Use SMOOTHEX for maximum
BRIGHTNESS • THROWING POWER • PLATING SPEED

SMOOTHEX provides an instant sparkling brilliance that occurs at the beginning of the plating cycle in a Rochelle Cyanide Copper Solution. It has exceptional speed of deposition and excellent throwing power. Brightness is achieved over a much greater range . . . from zero to eighty amperes per square foot. Ductile deposits and low copper concentrations are featured in this process. Periodic reverse or intermitting current may be applied to the SMOOTHEX process.

The SMOOTHEX Process Is
98% EFFICIENT
IT ELIMINATES COPPER BUFFING and SAVES NICKEL!

A SMOOTHEX Trial Proves
• EASE OF CONTROL • INSTANT SPECULAR BRIGHTNESS • LOW MAINTENANCE COST • LOW OPERATING COST • ADAPTABILITY

A Modern, Well-Equipped Laboratory is at Your Service to Convert Other Processes to SMOOTHEX

Send Your Sample Solution for Conversion Information TO *Pat. Pend.

SMOOTHEX, inc. 10705 BRIGGS ROAD CLEVELAND 11, OHIO

RESEARCH

MORE FACTS—ABOUT THE A.E.S. RESEARCH PROGRAM

An Active Program?—and How!

Unless you have been giving particular attention to your Society's Research Program, you probably haven't realized the amount of continuous activity involved. This activity is emphasized by the fact that each issue of PLATING magazine contains at least one report on an active project.
Since June, the following reports have been published:

Research Program Reports Appearing in PLATING

Month	Page	Project	Report
June '53	633	No. 12—Cleaning and Preparation of Metals for Electroplating	VI.—Sensitivity of Degreasing Evaluation Tests
July '53	777	No. 10—Disposal of Plating Room Wastes	III.—Treatment of Cyanide Waste Solutions with Ozone
August '53	898	No. 11—Current and Metal Distribution in Electrodeposition	III.—Experimental Determination of Metal Distribution
September '53	1011	No. 6—Nature and Effect of Porosity of Electrodeposits	XI.—Analysis of Corrosion Products as a Method of Measuring the Change of Porosity in Corrosion

Look these reports over, realize that they cover only a **PART** of the progress in a **FEW** of the projects, and surely you'll have an increased appreciation of the Research Program.

Yes, THE A.E.S. RESEARCH PROGRAM *Is Important*

★ — to you
★ — to your company
★ — to the Electroplating Industry

Assist your Branch Research Chairman in his efforts to obtain additional Sustaining Memberships.

• • •

INVEST NOW!!!

"YOUR BEST BET'S THE AES RESEARCH PROGRAM"

Membership Report of the A. E. S.

Elections

ADELAIDE: M. L. Tune

BRIDGEPORT: Don Gaines, William Hyatt, Jr., Otto Lovens, J. Manganello, C. J. Monaco, A. Tetu, J. Virgalla

CHICAGO: B. G. Allen, E. J. Proskocil

CINCINNATI: John R. Holaday

CLEVELAND: Charles A. Masek, Stephen P. Pozone, Robert C. Sasena

DAYTON: N. A. Mollman, A. Watson, Jr.

DETROIT: James L. Bretz, James A. Gordon, Richard J. Wisniewski

GRAND RAPIDS: Robert O. Bennett, Livingston E. Cole, Charles W. Crane, Patrick H. Norton, William S. Springer

HARTFORD: Peter F. K. Schmidt

LOS ANGELES: Virginia Herbert

LOUISVILLE: William B. Drake

MELBOURNE: J. Davin, E. H. Foster

MILWAUKEE: Stephen Choren, Oscar Printz, Steven Schmaling, Clyde N. Shepherdson, Orville R. Winfield

NEW YORK: Charles Antmann, Patrick A. Cavuto, Armand L. Galassi, Charles J. Martin, R. F. Morriss, J. H. von Rohr

ROCHESTER: Thomas R. Craig, Carl V. Greene, Orrin B. Webber, Jr.

ST. JOSEPH VALLEY: C. W. Farrell

ST. LOUIS: Theobald A. Leonhardt, George E. Parisho, Carl I. Schaeffer, William E. Schwarz, Homer P. Thomen

SAN FRANCISCO: Arthur J. King

SPRINGFIELD: William F. Houlihan, Jr., Edward T. Mish, Pat V. Romano

SYDNEY: L. F. Goldsmith, L. A. James

SYRACUSE: Smith A. Botting, John Casella, J. Richard Cullen, Sr., R. J. Hilgenberg, Floyd F. Kennedy, Edward L. Morgan, William C. Wood

TORONTO: A. G. Spicer, G. W. Stein

WATERBURY: George Tatoian

Reinstatements

MELBOURNE: D. J. Broadley, F. D Carorll

ROCHESTER: Frank Beuckman

TOLEDO: Clifford Cole

Transfers

Thomas M. Rodgers from Philadelphia to Baltimore-Washington; Howard L. Wright to Philadelphia from Baltimore-Washington; L. J. Howard from Detroit to Cincinnati; John Gorman from Detroit to Cleveland; Paul D. Harper to Boston from Detroit; R. K. Martin from Louisville to Grand Rapids; James Weaver to Dallas from Houston; Richard G. Marshall from Dayton to Louisville; Stephen Hebel from Member-at-Large to Milwaukee; Isadore Cross to Waterbury from New York; Otto Kardos to Newark from New York; Sam Rosenblatt to New York from Providence-Attleboro

Resignations

BRIDGEPORT: J. Charleson, L. London

BUFFALO: M. R. Kirk

DALLAS-FT. WORTH: R. S. Sloan, Jr.

DETROIT: Henry J. Baecker, Earl J. Roy, Bernard F. Walker

Membership Competition

BRANCH	Membership Apr. 1, 1953*	New Members	Net Change Membership	Per Cent Net Change
First Group				
Los Angeles	236	24	+17½	+ 7.4
Cleveland	236	11	+ 9½	+ 4.0
Newark	251	7	+ 6½	+ 2.6
New York†	352	22	+ 8	+ 2.3
Chicago	477	16	+ 9½	+ 2.0
Grand Rapids	173	5	+ 3	+ 1.7
Toronto	146	4	+ 2	+ 1.4
Pittsburgh	142	3	+ 1	+ 0.7
Waterbury	130	6	+ ½	+ 0.4
Detroit	504	15	+ 1	+ 0.2
Philadelphia	198	14	0	0
Boston	155	...	...	...
Hartford	151	6	− ½	− 0.3
Melbourne	169	16	− 2	− 1.2
Bridgeport	158	7	− 4	− 2.5
Milwaukee	164	11	−25	−15.2
Second Group				
Montreal	80	8	+ 8	+10.0
Dayton	76	8	+ 5½	+ 7.4
San Francisco	74	9	+ 4	+ 5.4
Rochester	107	8	+ 3½	+ 3.3
Syracuse	128	15	+ 3	+ 2.3
Saginaw Valley‡	103	5	+ 2	+ 1.9
Indianapolis	105	...	− 1	− 1.0
Twin City	71	1	− 1	− 1.4
Cincinnati	92	4	− 2	− 2.2
Sydney	82	8	− 2	− 2.4
Baltimore-Washington	93	7	− 3	− 3.2
St. Joseph Valley	78	4	− 3	− 3.8
New Haven	100	...	− 5½	− 5.5
Providence-Attleboro	95	1	− 5½	− 5.8
Buffalo	106	1	−12	−11.3
St. Louis	109	8	−18	−16.5
Third Group				
Springfield	57	10	+ 9	+15.8
Western Ontario	22	2	+ 2	+ 9.1
Wichita	41	3	+ 3	+ 7.3
Rockford	63	2	+ 2	+ 3.2
Columbus	52	1	+ ½	+ 1.0
Kansas City	46	6	0	0
Adelaide	52	5	0	0
Southeastern	50	2	0	0
Hamilton	25	...	...	...
Jackson-Lansing	61	...	...	...
Lancaster	69	...	...	...
Houston	42	...	− ½	− 1.1
Allentown-Reading	53	...	− 4	− 7.5
Dallas-Fort Worth	53	...	− 5	− 9.4
Toledo	56	2	− 8	−14.3
Louisville§	44	1	− 6½	−14.8
Outside Competition				
Portland	...	18	...	...
At Large	138	16	+13	...
Total A. E. S.	6,065	323	+23	+ 0.4

Active Membership, September 30, 1953 6,088

*Subject to correction. †, ‡, §Winners in first, second and third groups, respectively of 1952–1953 membership competition.

KANSAS CITY: M. B. Flint, Robert J. Steininger
PROVIDENCE-ATTLEBORO: Harry Cooper, Michel A. Napolitano
ROCHESTER: W. Hawley, R. C. McGlenn
SAN FRANCISCO: Earl F. Beeman

Suspensions

BALTIMORE-WASHINGTON: Charles W. Boll, Jr., Jonathan Booker, Alvin D. Fewell, John B. Houck, Jr., Joseph H. James, Maurice J. Krane, Frank X. McNally, Ernest E. Strober
BRIDGEPORT: Joseph A. Abbate, Frederic E. Adams, Victor M. Caltham, John J. Kezi, Michael Milo, Larry M. Rasmussen, Robert J. Rowe, J. P. Smith
BUFFALO: Nicholas Bartolo, B. A. Ferguson, G. A. Kinney, E. D. Laing, Henry McConnell, E. McCutcheon, Charles Melkaisian, Byron C. O'Keefe, Fred D. Sinclair, E. E. Smith, Jr.
DALLAS-FT. WORTH: George W. Fitzhugh, B. L. Huffer, C. P. LaVelle, Robert M. Worrell
MILWAUKEE: Bert G. Allen, J. Baltzell, Joseph Birbaum, Lester V. Birbaum, Sylvester R. Boruchi, Herman Braun, Leonard B. Bruch, Frank Buschner, Eugene M. Bykowski, John R. Crawford, William R. Cunningham, Nicholas Di Cesare, Peter C. Frandson, Milton Johnson, Clifford L. Jung, Frederick A. Lemke, John Lindsay, Richard R. McGuire, Stanley E. Mey, Joseph T. Minorik, J. Moyes, Paul R. Nesson, S. L. Perkins, Tony Peters, Arwin G. Piepenhagen, Frederick A. Rabe, Eugene J. Rechlicz, Eugene F. Rinehart, Robert Seeber, Richard Servatius, Jerome Stowasser, Herbert F. Thieman, George P. Varnish, Elmer Wentorf, Charles W. Wheeler, James F. Wright
NEW YORK: William Puntz, W. P. Schilling
PHILADELPHIA: Charles E. Atkinson, Harvey Von E. Doering, John J. Gumpper, John R. McCullough, David Polsky, Anthony Valente, Robert S. Weisman.
PROVIDENCE-ATTLEBORO: Joseph A. Allard, F. Kolling, J. R. Pacheco
ROCHESTER: Herman Ey
ST. JOSEPH VALLEY: Edwin C. Feehrer, Edwin Krook, Mearle Oswald, Don Pockock, Harold Sherk, W. Spillman, Jr.
ST. LOUIS: Robert N. Beger, Robert W. Bignal, Robert M. Bruce, Albert B. Chance, Edward Dutchmaneck, Francis Flachs, H. Gros, C. E. Heil, L. A. Horowit, Francis X. Kaiser, Max S. Kaiser, R. C. Kells, Donald I. Malter, E. K. Mueller, Vernon A. Nieberlein, John O'Malley, O. William Schneider, Jr., H. Y. Shirr, William Sullivan, Julius Turk, James Waldron, C. Yauch
SYRACUSE: Anthony F. Rotoli

Deaths

BRIDGEPORT: Ben Kusterer
GRAND RAPIDS: Russell Fancher
NEW YORK: Edwin C. Baker
PHILADELPHIA: William J. Weder, Sr.
ST. LOUIS: P. Chandeysson

It's the Finish that Counts

ROTO FINISH

Roto-Finish COMPOUNDS AND CHIPS ARE MADE TO GIVE YOU THE PROPER FINISH ECONOMICALLY

There are other brands of materials that resemble Roto-Finish chips and compounds . . . but only Roto-Finish chips and compounds give you the *extra advantage* of continuous research by the company who originated the Roto-Finish processes. Roto-Finish chips and compounds are carefully manufactured so *you* obtain the best results on *your specific job*. To obtain the best results at the lowest cost . . . insist on ROTO-FINISH chips and compounds.

ROTO-FINISH puts your grinding, deburring descaling, polishing, britehoning or coloring operations ON A MASS PRODUCTION BASIS

SAVES MAN HOURS AND MONEY by eliminating hand finishing.
GIVES ABSOLUTE UNIFORMITY...in any quantity.
MAINTAINS PRECISION TOLERANCES.
CUTS FINISHING costs as much as 80%.
LOWERS INITIAL and MAINTENANCE costs.

ROTO-FINISH COST-FREE ENGINEERING SERVICE GUARANTEES RESULTS

Put the experience and facilities of Roto-Finish to work for you on *your special finishing problems.*

Send a few unfinished parts to us . . . plus a finished part as a guide. We *guarantee* that you will get the same results in your plant that we produce in our laboratory. There's no obligation.

Write for fact-packed Roto-Finish catalog for complete information.

Roto-Finish COMPANY

associated with The Sturgis Products Co.
3703 MILHAM ROAD, KALAMAZOO, MICH.

P. O. Box 988 — Phone 3-5578

FOREIGN REPRESENTATIVES: CANADA — Windsor — Roto-Finish Canada Limited • ENGLAND — London — Roto-Finish Limited — 39 Park Street — Mayfair • AUSTRALIA — Melbourne — A. Flavell Pty, Ltd. • HOLLAND — Delft — N. V. Roto-Finish Maatschappij — Rotterdamse — WEG 370A • AUSTRIA, GERMANY, SWITZERLAND — Frankfurt a.M. — Metallgesellschaft A.G., Germany • ITALY — Milan — Societa Roto-Finish a R.L. — Sesto S. Giovanni — Viale E. Marelli 31 • FRANCE — Paris — Societe Roto-Finish, 70 rue de la Republique-Puteaux (Seine) • BRAZIL — Rio de Janeiro — Commercial E. Industrial de Formos Werco, Ltds.

FOR FURTHER INFORMATION, USE READER SERVICE CARD: INDICATE A 1382.

Seeley Compounds

—

offer a choice of the
Right Type
For All Metal Finishing

—

Burring — Polishing — Buffing

—

E. E. SEELEY COMPANY, INC.
Bridgeport, 1, Conn.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 1383.

SAVE BREAKAGE . . .
SAVE MONEY . . .

Inside Dimensions
14" Wide
18" Deep

With this new 12 gal. semi-hard rubber container for acids and bright dips.

only $15.00

- Here's a container made of thick hard rubber that will outlast stoneware jars or crocks and save you time and money.
- Won't Break or Crack.
- No unnecessary loss from spillage.
- Safer for your employees.

ORDER YOURS NOW . . .

PLATING PRODUCTS, Inc.
1509 North Washington Kokomo, Indiana

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 1384.

Directory of A. E. S. Officers and Research Chairman Branch Secretaries and Research Chairmen

A. E. S. OFFICERS

President.....Dr. G. P. SWIFT
53 Galen Street, Watertown 72, Mass.

First Vice-President.....Dr. R. A. SCHAEFER
Clevite-Brush Development Co.,
Division of Clevite Corporation
17000 St. Clair Avenue, Cleveland 10, Ohio

Second Vice-President.....CLYDE KELLY
Superior Plating Works
4600 Palmer St., Chicago, Ill.

Third Vice-President....DR. SAMUEL HEIMAN
Philadelphia Rust Proof Company
3221 Frankford Avenue, Philadelphia 34, Pa.

Past President.....F. J. MacSTOKER
Farrand Optical Company, Inc.
4401 Bronx Boulevard, Bronx, N. Y.

Executive Secretary.....P. PETER KOVATIS
445 Broad Street, Newark, N. J.

A. E. S. RESEARCH COMMITTEE

Chairman.....Dr. Earl J. Serfass
Lehigh University, Bethlehem, Pa.

Secretary.....The Executive Secretary

ADELAIDE, AUSTRALIA meets second Wednesday of each month. Secretary, R. J. Down, Room 30, 17 Currie Street, Adelaide, S. A., Australia.

BALTIMORE-WASHINGTON meets second Tuesday of each month with meetings in Baltimore at the Engineers' Club and in Washington, D. C., at the National Bureau of Standards. Secretary, Carl H. Thiede, 8426 Piney Branch Road, Silver Springs, Md.

DALLAS-FORT WORTH: Secretary-Treasurer, A. C. Fricke, 212 Julien Street, Dallas 8, Texas.

HOUSTON meets third Tuesday of each month at 6:30 P. M. in the Ben Milam Hotel, Houston, Texas. Secretary-Treasurer, Forest Baskett, 1240 Overhill, Houston, Texas.

MELBOURNE, AUSTRALIA meets third Thursday of each month at 8 P. M. in Metallurgy Theatre, Melbourne Technical College, 124 Latrobe Street. Honorary Secretary-Treasurer, S. B. Pearce, 11 Waterloo Street, Carlton, Melbourne, Australia.

PORTLAND. Secretary, K. B. Humphrey, 1905 N. E. Saratoga Street, Portland 11, Ore.

SPRINGFIELD meets fourth Monday of each month in Hotel Charles. Secretary, Roger R. Heroux, 1497 Longmeadow Street, Longmeadow, Mass. Research Finance Committee Chairman, Arthur Pearson, 102 Ely Avenue, W., Springfield, Mass.

SYDNEY, AUSTRALIA meets second Thursday of each month at 7:30 P. M. in the Trust Building, King and Castlereagh Streets. Secretary-Treasurer, B. Bridgement, 2 Alkoomie Street, Beverley Hills, N. S. W., Australia.

TORONTO meets second Friday of each month in Royal York Hotel. Secretary, Robert L. Edwards, 1106 Dovercourt Road, Toronto, Ont., Canada. Research Finance Committee Chairman, K. Wells, 370 Victoria Avenue, Toronto, Ont., Canada.

WESTERN ONTARIO meets third Friday of each month in William Pitt Hotel, Chatham, Ontario. Secretary-Treasurer, K. W. Farquhar, 54 Napier Street, Ltd., Wallaceburg, Ontario, Canada.

FOR PRECISION STOPS . . .

IN SELECTIVE PLATING . . .

MICCROSTOP

. . . is designed to achieve an accurate line of demarcation in all plating cycles. It will go through cleaners and hot solutions without losing its exceptional adhesion, unsurpassed on sharp edges. The finest all purpose stop-off lacquer on the market today.

MICCROMASK

. . . is specifically designed for maximum adhesion in hard chrome plating. It will hold to a fine line and may be easily removed after plating. Dries rapidly. Multiple coats will take any long cycle without treeing.

Note: Both MICCROSTOP and MICCROMASK may be removed easily in MICCROSTRIP A.

MICCROWAX

. . . C-562 is the outstanding product for the most efficient method of selective hard chrome plating. Melting at 180°F, it is especially applicable for flat surfaces and sharp edges, where dipping is feasible.

. . . C-600 will take all plating cycles without losing adhesion. Melting at 300°F, it is not affected by temperatures, acids, or caustics used in any plating operation.

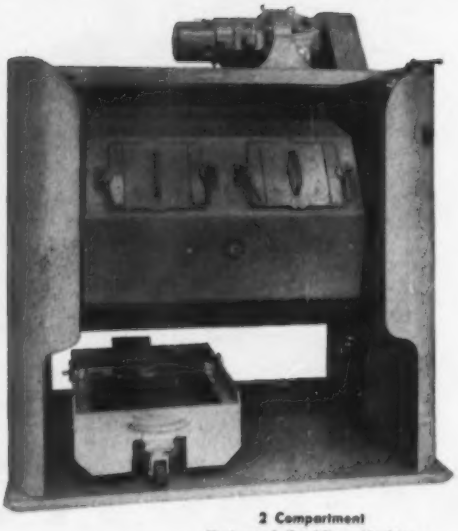
Both MICCROWAX C-562 and C-600 may be reused. Only one dip tank is required. Both harden immediately, cutting down application time to a minimum.

Write for detailed bulletins giving full information on the above products.

MICCRO Products

MICHIGAN CHROME
and Chemical Company
8615 Grinnell Avenue • Detroit 13, Michigan

CROWN TUMBLE
DEBURRING EQUIPMENT



2 Compartment
Horizontal Tumbling Machine

To deburr and tumble finish metal parts

Crown's complete line of newly improved tumbling machines and labor saving accessories provide huge savings in time-costs and labor.

- Light weight — quick acting "seal tite" doors with easily replaceable gasket.
- Front safety guard.
- Forward and reverse switch to rock barrel in rinsing and to position doors for loading and unloading.
- Easily accessible motor and bearings.
- Rubber lined — Neoprene lined — unlined.
- Special machines designed and built

Single Compartment
Horizontal Tumbling Machine

Mechanical Separating Table
Hoist Pan Type

Separating Table
Hand Type

Separator — Motor Drive
with Hopper

Chip or Tumbling
Abrasive Bin

WRITE FOR OUR COMPLETE CATALOG OF TUMBLING MACHINES AND ACCESSORY EQUIPMENT

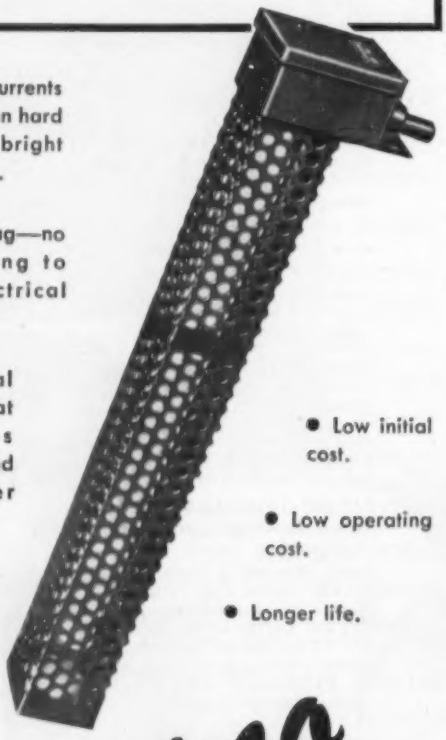
CROWN RHEOSTAT AND SUPPLY COMPANY

3465 N. KIMBALL AVENUE • CHICAGO 18, ILLINOIS

Index to Advertisers

ACME FISHER COMPANY 1285
Agency: The Mullican Co.
ALLIED RESEARCH PRODUCTS, INC. 1210
Agency: Emery Advertising Corp.
ALMCO DIV., QUEEN STOVE WORKS, INC. 1284
Agency: Weston-Barnett, Inc.
ALSOP ENGINEERING CORPORATION 1289
AMERICAN CHEMICAL PAINT CO. 1297
Agency: May Advertising Company
AMERICAN ELECTROPLATERS' SOCIETY 1305
BACON FELT COMPANY 1286
Agency: Sanger-Funnell, Inc.
M. E. BAKER COMPANY 1212
BART-MESSING CORPORATION 1292
Agency: Bass & Company, Inc.
BEACON SUPPLY CO. 1225
BEAM-KNODEL COMPANY 1281
BEHR-MANNING CORPORATION 1303
Agency: Peterson & Kempner, Inc.
BELKE MANUFACTURING COMPANY 1221
Agency: Allbright Associates
BETTER FINISHES & COATINGS, INC. 1208
Agency: James J. McMahon, Inc.
BUCKINGHAM PRODUCTS COMPANY 1294
Agency: Dudgeon, Taylor & Bruske, Inc.
CEILCOTE COMPANY 1280
Agency: Carpenter Advertising Company
THE CHEMICAL CORPORATION 1288
Agency: Wm. B. Remington, Inc.
CHEMICAL PRODUCTS CORP. 1276
Agency: Geo. T. Metcalf Company
CHEMSTEEL CONSTRUCTION CO., INC. 1276
Agency: Smith, Taylor & Jenkins, Inc.
CLEVELAND PROCESS CO. 1312
Agency: Scheel Advertising Agency
CRO-PLATE CO. 1284
Agency: Fairbairn & Co., Inc.
CROWN RHEOSTAT & SUPPLY COMPANY 1310
Agency: Shrout Associates
DAVIES SUPPLY & MANUFACTURING CO. 1217
Agency: Batz-Hodgson-Neuwoehner Adv. Agency
DUGGAN MASKING DEVICES 1278
Agency: James E. Lillis Advertising Agency
DU-LITE CHEMICAL CORPORATION 1271
Agency: Charles Palm & Company
DU PONT DE NEMOURS, E. I., & CO., INC. 1195
Agency: Batten, Barton, Durstine & Osborn, Inc.
ENTHONE, INCORPORATED 1191
Agency: Hugh H. Graham & Associates, Inc.
EXOLON COMPANY, THE 1279
Agency: Melvin F. Hall Adv. Agency, Inc.
FEDERATED METALS DIVISION, AMERICAN SMELTING & REFINING CORPORATION 1198
Agency: John Mather Lupton Co., Inc.
FIDELITY CHEMICAL PRODUCTS CO. 1282
Agency: Art-Copy Advertising Agency
FORMAX MANUFACTURING COMPANY 1216
Agency: Brindley-Roth, Inc.
GENERAL CHEMICAL DIV., ALLIED CHEMICAL & DYE CORP. 1207
Agency: Atherton & Currier, Inc.
GENERAL ELECTRIC COMPANY 1219
Agency: G. M. Basford Company
W. GREEN ELECTRIC COMPANY 1199
Agency: Shappe-Wilkes, Inc.
FREDERICK GUMM CHEMICAL CO., INC. ..... 2nd Cover
Agency: Schniedenbach Studios
HAMMOND MACHINERY BUILDERS 1200
HANSON-VAN WINKLE-MUNNING CO. 1250–1251
Agency: O. S. Tyson & Co., Inc. ..... 4th Cover
THE HARSHAW CHEMICAL COMPANY 1228
H. N. HARTWELL & SON, INC. 1287
Agency: H. B. Humphrey, Alley & Richards, Inc.
HAVEG CORP. 1194
Agency: Geare-Marston, Inc.
R. O. HULL & COMPANY, INC. 1201
Agency: Ralph M. French Advertising
KOCOUR COMPANY 1196
Agency: DeCasseres & Associates
JOSEPH B. KUSHNER 1281
THE LEA MANUFACTURING COMPANY 1222
Agency: Sanger-Funnell, Inc.
CHARLES F. L'HOMMEDIEU & SONS COMPANY 1275
MAC DERMID, INCORPORATED ..... 3rd Cover
Agency: Jackson-Hall Co.
MAGNUS CHEMICAL COMPANY 1302
Agency: Spooner & Kriegel
MAGNUSON PRODUCTS CORPORATION 1220
Agency: Asher, Godfrey & Franklin, Inc.
THE MEAKER COMPANY 1192
Agency: Merrill, McEnroe & Associates, Inc.
MICHIGAN BUFF CO., INC. 1285
MICHIGAN CHROME & CHEMICAL CO. 1309
Agency: Karl G. Behr Advertising Agency
J. C. MILLER COMPANY 1203
Agency: James Philip Reed
MINNESOTA MINING & MFG. COMPANY 1272
Agency: Batten, Barton, Durstine & Osborn, Inc.
MUTUAL CHEMICAL CO. OF AMERICA 1204
Agency: The House of J. Hayden Twiss
NANKERVIS COMPANY, GEORGE L. 1300
Agency: Charles M. Gray & Associates
NATIONAL RACK COMPANY 1202
Agency: John Philips Advertising Company
NOBLES ENGINEERING & MFG. COMPANY 1218
Agency: E. W. Sann & Associates
NORTHWEST CHEMICAL COMPANY 1252
Agency: F. B. Hubert Advertising Counsel
OAKITE PRODUCTS, INC. 1274
Agency: Rickard & Company
THE PATENT BUTTON CO. 1212
Agency: Edward Graceman & Associates
PENNSYLVANIA SALT MFG. COMPANY 1197
Agency: Geare-Marston, Inc.
THE PIONEER RUBBER CO. 1276
Agency: Carr Liggett Advertising, Inc.
PLATING PRODUCTS, INC. 1308
Agency: Frank Gregory & Associates
POWERS REGULATOR COMPANY 1298–1299
Agency: Symonds, MacKenzie & Company
PROMAT DIV., POOR & COMPANY 1213
Agency: Russell T. Gray, Inc.
ROTO-FINISH COMPANY 1307
Agency: The Jaqua Company Advertising
SARCO COMPANY, INC. 1283
Agency: Rickard & Company
SCHAFFNER MANUFACTURING CO., INC. 1193, 1312
Agency: Advance Advertising Company
E. E. SEELEY COMPANY, INC. 1308
SELLERS ENGINEERING CO. 1211
Agency: Simmonds & Simmonds, Inc.
SEL-REX PRECIOUS METALS, INC. 1205
Agency: Bass & Company
SETHCO 1278
Agency: Harry Hurst Advertising
THE SEYMOUR MANUFACTURING CO. 1291
Agency: Claude Schaffner Advertising Agency
SMOOTHEX, INC. 1304
Agency: Howe Advertising
SPARKLER MANUFACTURING COMPANY 1215
Agency: Kreicker & Meloan, Inc.
SPECIAL CHEMICALS CORP. 1284
Agency: Schneider-Stogel Company
STANDARD RESEARCH, INC. 1280
Agency: Peck Bros. Advertising
STEVENS, FREDERIC B., INC. 1226
Agency: Grant Advertising, Inc.
STORTS WELDING COMPANY, INC. 1204
Agency: Harold S. Card
STUTZ, GEORGE A., MFG. COMPANY 1293
Agency: Sander Rodkin Adv. Agency, Ltd.
SULPHUR PRODUCTS CO., INC. 1281
TRUE BRITE CHEMICAL PRODUCTS CO. 1206
THE UDYLITE CORPORATION 1277
Agency: Grant Advertising, Inc.
UNIT PROCESS ASSEMBLIES, INC. 1280
Agency: State Advertising Service
UNITED CHROMIUM, INCORPORATED 1249
Agency: Rickard & Company, Inc.
WAGNER BROTHERS, INC. 1301
Agency: Fred P. Bingham, Technical Advertising
WILLIAMSVILLE BUFF DIV., BULLARD CLARK COMPANY 1209
Agency: Gordon Schonfarber & Associates, Inc.
WYANDOTTE CHEMICALS CORPORATION 1214
Agency: Brooke, Smith, French & Dorrance, Inc.

for better
ACID TANK HEATING
at lower cost



- No stray currents ...for precision hard chrome and bright nickel plating.
- No heat lag—no heavy casing to absorb electrical energy.
- Electrical radiant heat eliminates usual fog and fumes over tank.
- Constant, dependable controlled heat.
- Low initial cost.
- Low operating cost.
- Longer life.

Clepco

G-SERIES FUSED QUARTZ
IMMERSION HEATERS

Clepco is the only fused quartz immersion heater recommended and sold by all leading Plating Supply Houses. There are more than 40,000 Clepco fused quartz immersion heaters in service throughout the U.S.A. That's positive proof of satisfaction and dependability.

Wide range of standard sizes to meet every need. Ask your Supply House for Clepco literature, or write direct to us.

For alkaline solutions, specify Clepco heavy duty series W Steel Jacketed Immersion Heaters.

CLEVELAND PROCESS COMPANY
7016 EUCLID AVENUE • CLEVELAND 3, OHIO

Future Meetings

GRAND RAPIDS BRANCH, A. E. S. Annual Ladies' Night on November 6, 1953 at Finger's Restaurant.

SAGINAW VALLEY BRANCH, A. E. S. Past Presidents' Night on November 11, 1953 at Zehnder's, Frankenmuth, Mich.

PHILADELPHIA BRANCH, A. E. S. Annual Educational Session (1:00 P. M.) and Dinner-Dance (7:00 P. M.) at the Broadwood Hotel, Philadelphia on Saturday, November 21, 1953.

DETROIT BRANCH, A. E. S. Annual Educational Session, Friday, December 4, 1953 at 8:00 P. M.; Christmas Party, Saturday, December 5, 1953 at 7:00 P. M.

RESEARCH COMMITTEE, A. E. S. at the Statler Hotel, Detroit, Mich., on Saturday, December 5, 1953 at 10:00 A. M.

INTERIM MEETING, A. E. S., at the Royal York Hotel, Toronto, Ontario, Canada on February 13, 1953 at 10:00 A. M.

Schaffner brings you
Another First FREE

Schaffner's new Buff 'n Polish Calculator gives the answers to all your buffing problems! It shows the proper compound, buff and SFPM required to achieve any finish on any material. There's no need to experiment when you get special jobs involving unfamiliar materials if you have a Buff 'n Polish Calculator.

Fill out the coupon to obtain yours today!!

Clip To Your Letterhead

Schaffner manufacturing company, inc.
SCHAFFNER CENTER, EMSWORTH, PITTSBURGH 2, PA.
Please send a Buff 'n Polish Calculator to:
Name _____
Title _____
Company _____
Street _____
City _____ Zone – State _____

Schaffner manufacturing company, inc.
Observed 1-1952
SCHAFFNER CENTER, EMSWORTH, PITTSBURGH 2, PA.

ALUMETEX

Improved process for electroplating directly on aluminum which assures excellent adhesion and lustre for any electrodeposit on all commercially used alloys of aluminum.

Write for Data Sheet #13

DEOXIDEX

A process for preparing aluminum for spot welding. This process gives low surface contact resistance readings uniformly all over the aluminum article processed. Aluminum can be stored after treatment and still maintain low resistance readings.

Write for Data Sheet #25

ALUMINUM BRIGHT DIP

Improved, MacDermid, Inc., acidic formula developed to produce a brilliant lustre to most types of non-silicon aluminum alloys.

Write for Data Sheet #21

METEX FS STRIPPER

A dry acid salt used with Nitric Acid to remove smut and oxides from aluminum by simple one-minute chemical immersion. Anodized coatings can be stripped in the same solution with no attack on the aluminum surface.

Write for Data Sheet #24

ALUMINUM CLEANERS & BURNISHING COMPOUNDS for SPECIFIC PURPOSES

MacDermid, Incorporated, have perfected numerous variations of etch and non-etch alkaline cleaners and burnishing compounds for use under individual conditions and for specific requirements with all types of equipment. To determine the compound best suited for your particular requirements.

Write for Data Sheet #24

MAC DERMID

★ *Incorporated* ★

WATERBURY 20, CONNECTICUT

FOR 31 YEARS *Originators* FOR THE METAL FINISHING INDUSTRY

there's real ventilation— 24 air channels in every H-VW-M Ruff-L-Buff!

Patent No. 2,140,208

Evenly distributed ventilation, too. That means air-cooled operation even under severest use—more pressure without burning—faster cut—more composition mileage—and longer life for the buff. Air rushes into those extra large holes at the center, circulates right through the wheel, and escapes at the face. This constant flow of air—plus the fanning effect of the ruffles at the face—*eliminates excessive heat.*

Now take a look at the rest of these features: There's an extra safety factor in the rugged steel ring that anchors the cloth at the center; every buff is perfectly balanced; and that exclusive H-VW-M Red-E-To-Use Face is all set to take composition without raking or truing. Ruff-L-Buffs are available in a wide variety of types and weights for any application—to do a *better* buffing job for *you.*

Top quality buffs are just one of many results of over eighty years of constant electroplating and polishing development—a continuing policy summed up in H-VW-M Platemanship . . . your working guarantee of the best that industry has to offer—not only in buffs—but in every phase of plating and polishing. ®

PLATEMANSHIP

For full information on Ruff-L-Buffs as well as all H-VW-M buffs ask for Bulletin B-101.

Your H-VW-M combination—of the most modern testing and development laboratory—of over 80 years experience in every phase of plating and polishing—of a complete equipment, process and supply line for every need.

HANSON-VAN WINKLE-MUNNING CO., MATAWAN, N. J.
PLANTS AT: MATAWAN, N. J. • ANDERSON, INDIANA
SALES OFFICES: ANDERSON • BALTIMORE • BOSTON
CHICAGO • CLEVELAND • DAYTON • DETROIT • GRAND RAPIDS • LOS ANGELES • LOUISVILLE • MATAWAN
MILWAUKEE • NEW YORK • PHILADELPHIA • PITTSBURGH
ROCHESTER • SPRINGFIELD (MASS.) • STRATFORD (CONN.)
UTICA • WALLINGFORD (CONN.)

H-VW-M

INDUSTRY'S WORKSHOP FOR THE FINEST IN PLATING AND POLISHING PROCESSES • EQUIPMENT • SUPPLIES

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 1390.